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State Commissioner of Public Roads.

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Farnsworth Avenue, Bordentown,
Burlington county. Before improvement.



Farnsworth Avenue, Bordentown,
Burlington county, 8-inch macadam. After improvement.

SIXTH ANNUAL REPORT

OF THE

Commissioner of Public Roads

FOR THE YEAR ENDING OCTOBER 31ST,

1899.

CAMDEN, N. J.:
SINNICKSON CHEW & SONS, PRINTERS,
1899.

OFFICE OF COMMISSIONER OF PUBLIC ROADS, }
TRENTON, N. J., November 29, 1899. }

To the Governor and Legislature of New Jersey :

Pursuant to the requirements of the State Aid Law, I herewith submit the Sixth Annual Report of the Commissioner of Public Roads for the fiscal year ending October 31st, 1899, with such comments, quotations and suggestions as existing circumstances seem to require.

HENRY I. BUDD,
Commissioner of Public Roads.

REPORT.

In compliance with the act of June 15th, 1895, we make the following statement of cost of roads.

They will claim a share of this year's State appropriation, as indicated by the figures below :

COST OF ROADS.

ATLANTIC COUNTY.

Longport Drive road.....		3 1-11 miles.
Cost.. ..	\$21,219 21	
State's share.....	7,073 07	
Chestnut Neck road.....		8-11 miles.
Cost.....	\$1,671 21	
State's share.....	557 07	
Total number of miles.....		3 9-11 miles.
Total paid the County.....		\$7,630 14

BURLINGTON COUNTY.

Cross Roads and Ballenger's Mill road.....		3 6-7 miles.
Cost.....	\$12,198 00	
State's share.....	4,066 00	
Burlington and Mount Holly road.....		5 1-4 miles.
Cost.....	\$18,500 01	
State's share.....	6,166 67	
Farnsworth avenue and Park street.....		1 3-5 miles.
Cost.....	\$7,858 92	
State's share.....	2,619 64	
Columbus and Bowne's corner road.....		3 miles.
Cost.....	\$10,474 08	
State's shares.....	3,491 36	
Georgetown or Old York road.....		1 1-5 miles.
Cost.....	\$3,773 85	
State's share.....	1,257 95	
Trenton road.....		1 4-5 miles.
Cost.....	\$7,399 02	
State's share.....	2,466 34	

Mullica River road.....		1 3-4 miles.
Cost.....	\$5,063 76	
State's share.....	1,687 92	
Total number of miles.....		18 1-2 miles.
Total paid the county.....		\$21,755 88

CAMDEN COUNTY.

Park avenue.....		2 1-50 miles.
Cost.....	\$13,030 56	
State's share	4,343 52	
Massey avenue		5-24 mile.
Cost.....	\$ 1,221 00	
State's share	407 00	
Total number of miles.....		2 1-5 miles.
Total paid the county.....		\$4,750 52

ESSEX COUNTY.

Franklin avenue.....		3-5 mile.
Cost.....	\$ 3,923 31	
State's share	1,307 77	
Broad street.....		2 7-8 miles.
Cost	\$15,788 04	
State's share	5,262 68	
Bay avenue.....		6-11 mile.
Cost	\$ 4,395 15	
State's share	1,465 05	
Mount Hebron road.....		1 mile.
Cost	\$ 6,195 00	
State's share	2,065 00	
Watchung avenue		1 1-2 miles.
Cost	\$10,407 48	
State's share	3,469 16	
Bloomfield avenue		1 1-2 miles.
Cost	\$ 8,622 63	
State's share	2,874 21	
Fairfield road.....		4 miles.
Cost	\$19,988 67	
State's share	6,662 89	
Total number of miles ..		12 1-50 miles.
Total paid the County.....		\$23,106 76

GLOUCESTER COUNTY.

Franklinville road		6 miles.
Cost	\$ 8,265 21	
State's share	2,755 07	
Cross Keys and Hurffville road.....		3 miles.
Cost	\$ 4,674 81	
State's share	1,558 27	

COMMISSIONER OF PUBLIC ROADS.

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Woodbury and Knight's Run road.....		1 1-2 miles.
Cost	\$ 4,475 70	
State's share	1,491 90	
Broad street, Woodbury.....		4-5 mile.
Cost	\$ 6,500 01	
State's share	2,166 67	
Total number of miles		12 4-5 miles.
Total paid the County		\$7,971 91

MERCER COUNTY.

Pennington road.....		6 3-4 miles.
Cost	\$36,520 26	
State's share	12,173 42	
Asylum road		3 miles.
Cost	\$10,611 57	
State's share	3,537 19	
Upper Ferry road.....		1 1-6 miles.
Cost	\$ 3,503 01	
State's share	1,167 67	
Total number of miles.....		10 11-12 miles.
Total paid the County.....		\$16,878 28

MIDDLESEX COUNTY.

Cranbury road.....		2 1-5 miles.
Cost	\$ 9,145 56	
State's share	3,048 52	
George's road		4 2-3 miles.
Cost	\$17,692 38	
State's share	5,897 46	
Bound Brook and Lincoln road.....		2 1-4 miles.
Cost.....	\$ 6,057 99	
State's share.....	2,019 33	
Old Bridge road.....		3 miles.
Cost.....	\$15,417 60	
State's share.....	5,139 20	
Carteret road.....		2 miles.
Cost.....	\$ 6,729 42	
State's share.....	2,243 14	
Total number of miles.....		13 13-15 miles.
Total paid the County.....		\$18,347 65

MONMOUTH COUNTY.

Navesink, First avenue and Hillside road.....		2 1-2 miles.
Cost.....	\$4,734 12	
State's share.....	1,578 04	
Atkins avenue.....		2 miles.
Cost.....	\$3,942 00	
State's share.....	1,314 00	
Sweetman's lane and Tennent Station road.....		2 2-3 miles.
Cost.....	\$1,699 98	
State's share.....	566 66	

Red Bank and Eatontown road.....	3 miles
Cost.....	\$22,573 32
State's share.....	7,524 44
Lower Squankum and Turkey road.....	4 1-2 miles.
Cost.....	\$7,802 55
State's share.....	2,600 85
Total number of miles.....	15 3-50 miles.
Total paid the County.....	\$13,583 99

MORRIS COUNTY.

Denville and Pine Brook road.....	7 miles.
Cost.....	\$26,868 72
State's share.....	8,956 24
Hanover and Afton road.....	2 1-7 miles.
Cost.....	\$8,033 34
State's share.....	2,677 78
Rockaway and Hibernia road	8-9 mile.
Cost	\$5,600 82
State's share	1,866 94
Total number of miles	8 1-153 miles.
Total paid the County	\$13,500 96

PASSAIC COUNTY.

Midvale road	4 miles.
Cost	\$11,377 77
State's share	3,792 59
Milton road.....	1 2-3 miles.
Cost	\$ 8,849 49
State's share	2,949 83
Mountain View and Singac road.....	2 miles.
Cost	\$ 5,980 02
State's share	1,993 34
Great Notch road.....	1 mile.
Cost	\$ 5,662 68
State's share	1,887 56
Total number of miles	8 2-3 miles.
Total paid the County.....	\$10,623 32

SALEM COUNTY.

Hancock Bridge road	2 1-6 miles.
Cost	\$ 4,829 76
State's share	1,609 92
Total number of miles	2 1-6 miles.
Total paid the County.....	\$1,609 92

SOMERSET COUNTY.

Mine Brook road	6 3-5 miles.
Cost	\$30,162 00
State's share	10,054 00
Total number of miles	6 3-5 miles.
Total paid the County	\$10,054 00

WARREN COUNTY.

Front street, Belvidere.....		1-13 mile.
Cost	\$800 00	
State's share, 1-3 less 10 per cent. of cost.....	186 67	
Total number of miles.....		1-13
Total paid the County.....		\$186 67
Total cost to the State.....		\$150,000 00
Appropriation.....		\$150,000 00

Total cost of roads to both State and county is given further on in the more detailed statements of engineers and supervisors.

Specifications for the following roads have been and are being prepared, some of which are under and are being placed under contract for construction under the State appropriation for the fiscal year beginning November 1st, 1899, and ending October 31st, 1900:

ATLANTIC COUNTY.

	Miles.	Est. Cost.
Mays Landing and Tuckahoe road—gravel.....	11	\$11,000 00

BURLINGTON COUNTY.

Moorestown, Evesboro, Fellowship and Paul's road—stone.....	6	\$24,000 00
Ballenger's Mills and Indian Mills road—gravel.....	6	7,200 00
Columbus and Burlington road—stone.....	2	8,000 00
Mt. Holly and Jacksonville road—stone.....	3.58	20,000 00
Mt. Holly and Smithville road—stone.....	3	12,000 00
Bordentown and Wrightstown road—stone.....	4	16,000 00
Total.....	24.58	\$63,200 00

CAMDEN COUNTY.

Haddonfield and Magnolia road—stone.....	1.50	\$7,500 00
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ESSEX COUNTY.

Roseland avenue—stone.....	3.6	\$15,834 00
Parsonage road—stone.....	3.5	16,000 00
East Passaic avenue and Center street.....	1.3	6,667 00
East Passaic avenue.....	2	10,000 00
Elizabeth avenue.....	1.3	6,666 00
Fairfield road.....	1	5,000 00
Eagle Rock road.....	3.5	16,000 00
Total.....	16.2	\$76,167 00

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GLOUCESTER COUNTY.

	Miles.	Est. Cost.
Cross Keys and Hurffville road—gravel.....	2.40	\$ 1,815 20
Woodbury and Knights Run road—gravel and stone.....	4	12,224 29
Mullica Hill road—gravel.....	6.54	7,434 40
Bridgeport road—stone.....	6.02	23,700 00
Glassboro and Clayton road—gravel.....	4.87	8,000 00
Total.....	23.83	\$53,173 89

MERCER COUNTY.

Hightstown and York road—stone.....	3.25	\$14,625 00
White Horse and Crosswicks road—stone.....	4	18,000 00
Edinburg and Hightstown road—stone.....	6	27,000 00
Hightstown and Long Branch Extension—gravel.....	2	2,000 00
Portion of Upper Ferry road—stone; township road.....	1.3	5,035 00
Total.....	16.55	\$66,660 00

MIDDLESEX COUNTY.

Hightstown and Manalapan road—gravel.....	2.50	\$ 4,000 00
Old Bridge and New Brunswick road—stone.....	3.62	20,582 40
Carteret road—stone.....	1.60	8,450 00
Bound Brook and Lincoln road—stone.....	2.28	8,000 00
Cranbury and Hightstown road—gravel.....	1.33	1,600 00
Cranbury turnpike road—stone.....	8	40,000 00
Total.....	19 33	\$82,632 40

MONMOUTH COUNTY.

Valley Drive road—stone.....	2.85	\$16,727 00
Sweetman's lane and Tennent Station road—gravel and stone.....	5.58	10,044 00
Holmdel and Bradvelt road—stone.....	3.50	17,500 00
Brighton avenue and Long Branch road—stone.....	1.16	7,934 30
Hightstown and Manalapan extension—gravel.....	2	3,000 00
Total.....	15.09	\$55,205 30

MORRIS COUNTY.

William's Corner and Passaic River road—stone.....	3.15	\$16,065 00
Succasunna road—stone.....	.81	4,130 00
Stirling road—stone.....	2	10,000 00
Chester road—stone.....	1	5,000 00
Mendham and Somerset County Line road—stone.....	2.41	13,073 00
Total.....	9.37	\$48,268 00

COMMISSIONER OF PUBLIC ROADS.

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OCEAN COUNTY.

	Miles.	Est. Cost.
Long Beach road—gravel; township road.....	15	\$30,000 00
Seaside Park road—gravel.....	12	24,000 00
Total.....	27	\$54,000 00

PASSAIC COUNTY.

Union Avenue road—stone.....	2	\$ 5,820 00
Lackawanna avenue—stone.....	2	9,000 00
Mortonhouse and Bergen County road—stone.....	2	10,000 00
Midvale and Greenwood Lake road—stone.....	10	40,000 00
Lakeside avenue at Pompton—stone.....	1	3,000 00
Total.....	17	\$67,820 00

SOMERSET COUNTY.

East Millstone and New Brunswick road—stone.....	6	\$21,000 00
South Somerville extension—stone.....	2.50	12,000 00
Total	8.50	\$33,000 00

SUSSEX COUNTY—TOWNSHIP ROADS.

Wantage township line and Sparta township line—stone,	7	\$21,000 00
Vernon township line and Sparta township line—stone	3	9,000 00
Warwick and Newton road—stone.....	4	12,000 00
Hardystonville and Passaic County Line road—stone.....	6	18,000 00
Total.....	20	\$60,000 00

WARREN COUNTY.

Belvidere road—stone; township road.....	2	\$8,000 00
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Total number of miles.....211.95

Total estimated cost..... \$686,626 59

NAMES AND LENGTHS OF THE ROADS BUILT IN 1899.

ATLANTIC COUNTY.

Longport Drive.....	3 1-11 miles.
Chestnut Neck road.....	8-11 "
Total	3 9-11 "

BURLINGTON COUNTY.

Columbus and Bowne's Corner road.....	3 miles.
Georgetown and Old York road.....	1 1-5 "
Farnsworth avenue and Park street.....	1 3-5 "
Trenton road.....	1 4-5 "
Mullica River road.....	1 3-4 "
Burlington and Mount Holly road.....	5 1-4 "
Cross Roads and Ballenger's Mill road.....	3 6-7 "
Total.....	18 1-2 "

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CAMDEN COUNTY.

Park avenue.....	2 1-50 miles.
Massey avenue.....	5-24 "
Total.....	2 1-5 "

ESSEX COUNTY.

Franklin avenue.....	3-5 miles.
Broad street.....	2 7-8 "
Bloomfield avenue.....	1 1-2 "
Mount Hebron road.....	1 "
Bay avenue.....	6-11 "
Fairfield road.....	4 "
Watchung avenue.....	1 1-2 "
Total.....	12 1-50 "

GLOUCESTER COUNTY.

Woodbury and Knight's Run road.....	3 miles.
Cross Keys and Hurffville road.....	3 "
Franklinville road.....	6 "
Brood street, Woodbury.....	4-5 "
Total.....	12 4-5 "

MERCER COUNTY.

Pennington road.....	6 3-4 miles.
Asylum road.....	3 "
Upper Ferry road.....	1 1-6 "
Total.....	10 11-12 "

MIDDLESEX COUNTY.

Cranbury Station road.....	2 1-5 miles.
George's road.....	4 2-3 "
Carteret road.....	2 "
Old Bridge road.....	3 "
Bound Brook and Lincoln road.....	2 "
Total.....	13 13-18 "

MONMOUTH COUNTY.

Lower Squankum and Turkey road.....	4 1-2 miles.
Atkins avenue.....	2 "
First avenue and Hillside road.....	1 7-50 "
Navesink road.....	1 3 4 "
Red Bank and Eatontown road.....	3 "
Sweetman's Lane and Tennent Station road.....	2 2-3 "
Total.....	15 3-50 "

MORRIS COUNTY.

Rockaway and Hibernia road.....	8-9	miles.
Hanover and Afton road.....	2-17	"
Denville and Pine Brook road.....	7	"
Total.....	8 1-153	"

PASSAIC COUNTY.

Mountain View and Singac road.....	2	miles.
Great Notch road.....	1	"
Midvale road.....	4	"
Milton avenue.....	1 2-3	"
Total.....	8 2-3	"

SOMERSET COUNTY.

Mine Brook road	6 3-5	miles.
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SALEM COUNTY.

Hancock Bridge road ..	2 1-6	miles.
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WARREN COUNTY.

Front street, Belvidere.....	1-13	mile.
Total.....	1 14 2-3	miles.

During the years 1893 and 1894 there was built in

Middlesex county	16.09	miles.
Mercer county	12.78	"
Camden county	14.50	"
Burlington county	31.47	"
Total number of miles built in 1893 and 1894	74.76	"

During the year 1895 there was built in

Burlington county	9 3-4	miles.
Camden county.....	8 1-4	"
Essex county.....	6 1-2	"
Gloucester county	7 3-4	"
Middlesex county	7 5-8	"
Mercer county.....	6 2-5	"
Total number of miles built in 1895.....	46 1-4	

During the year 1896 there was built in

Atlantic county.....	12	miles.
Burlington county.....	11	1-60 "
Essex county.....	6	"
Gloucester county.....	6	"
Mercer county.....	10	19-20 "
Middlesex county.....	9	"
Monmouth county.....	3	3-4 "
Salem county.....	2	2-3 "
Total number of miles built in 1896.....	51	1-3

During the year 1897 there was built in

Atlantic county.....	10	1-2 "
Burlington county.....	10	"
Camden county.....	4	1-8 "
Essex county.....	5	"
Gloucester county.....	5	1-2 "
Mercer county.....	4	3-4 "
Middlesex county.....	4	3-4 "
Morris county.....	6	1-8 "
Monmouth county.....	5	"
Passaic county.....	4	3-4 "
Somerset county.....	6	1-5 "
Total.....	66	1-2+

During the year 1898 there was built in

Atlantic county.....	6	4-5 miles.
Burlington county.....	14	10-11 "
Camden county.....	12	4-5 "
Essex county.....	9	3-5 "
Gloucester county.....	7	3-5 "
Mercer county.....	2	7-10 "
Middlesex county.....	6	1-6 "
Monmouth county.....	5	1-9 "
Morris county.....	6	1-10 "
Passaic county.....	5	7-8 "
Somerset county.....	7	1-4 "
Total.....	84	1-2+

During the year 1899 there was built in

Atlantic county.....	3	9-11 miles.
Burlington county.....	18	1-2 "
Camden county.....	2	1-5 "
Essex county.....	12	1-50 "

Gloucester county.....	12 4-5 miles.
Mercer county.....	10 11-12 "
Middlesex county.....	13 13-15 "
Monmouth county.....	15 3-50 "
Morris county.....	8 1-153 "
Passaic county.....	8 2-3 "
Salem county.....	2 1-6 "
Somerset county.....	6 3-5 "
Warren county.....	1-13 "
Total.....	114 2-3

The total amount expended by the State and the number of miles built in each county since the passage of the State Aid Law are as follows :

County.	Miles.	Amount.
Atlantic.....	33 1-9	\$20,881 71
Burlington.....	94 7-11	156,453 20
Camden.....	42	78,156 38
Essex	38 3-5	72,764 15
Gloucester.....	39 3-5	50,447 18
Mercer.....	41 3-5	121,605 26
Middlesex.....	57 1-30	97,864 12
Monmouth....	29	31,239 49
Morris.....	20 5-21	29,025 50
Passaic.....	19 7-24	25,922 73
Salem.....	4 5-6	3,245 58
Somerset	20 1-10	28,034 09
Warren	1-13	186 67
Total.....	440 +	\$715,826 06
Total amount appropriated by the State.....		\$795,000 00

AMOUNT AVAILABLE FOR ROAD-BUILDING IN EACH COUNTY.

Under the State Aid Law, the estimated cost of all improvements made under this act, together with the estimated cost of repairs of roads already constructed in any county in any one year, shall not exceed one-fourth of one per centum of the ratables of such county for the last preceding year.

The following table will show at a glance the limitations of expenditures in each county, also the amount that can be expended, provided the State appropriation is liberal enough to

meet it. For example: Atlantic county, with ratables amounting to \$20,144,201.00, could expend per year, if State appropriation were sufficient, \$50,360.50 $\frac{1}{4}$ of its own money and \$25,180.25 $\frac{1}{8}$ of the State's money, altogether \$75,540.75 $\frac{3}{8}$; a rate, if applied to all the counties, even with the cost of repairs to roads already built deducted, would in a few years, cover all our leading roads with stone and gravel:

County.	Abstract of Rata- for 1899.	One-fourth of One Per Cent.
Atlantic.....	\$ 20,144,201 00	\$ 50,360 50 $\frac{1}{4}$
Bergen.....	44,058,4 5 00	110,146 13 $\frac{3}{4}$
Burlington.....	22,455,228 00	56,138 07
Camden.....	37,163,518 00	92,908 79 $\frac{1}{2}$
Cape May.....	6,749,029 00	16,872 57 $\frac{1}{4}$
Cumberland.....	16,694,777 00	41,736 94 $\frac{1}{4}$
Essex.....	203,932,000 00	509,830 00
Gloucester.....	14,326,516 00	35,816 29
Hudson.....	161,994,302 00	404,985 75 $\frac{1}{2}$
Hunterdon.....	17,572,928 00	43,932 32
Mercer.....	44,567,084 00	111,417 71
Middlesex.....	27,312,101 00	68,280 25 $\frac{1}{4}$
Monmouth.....	47,460,000 00	118,650 00
Morris.....	27,382,354 00	68,455 88 $\frac{1}{2}$
Ocean.....	7,785,385 00	19,463 46 $\frac{1}{4}$
Passaic.....	63,719,963 00	159,299 90 $\frac{3}{4}$
Salem.....	13,906,049 00	34,765 12 $\frac{1}{4}$
Somerset.....	18,563,673 00	46,409 18 $\frac{1}{4}$
Sussex.....	12,156,270 00	30,390 67 $\frac{1}{2}$
Union.....	39,767,600 00	99,419 00
Warren.....	18,318,339 00	45,795 84 $\frac{3}{4}$

The following roads have been and are being petitioned for to be improved under the State Aid Act:

ATLANTIC COUNTY.

Mays Landing and Pleasantville road, gravel, 12 miles; estimated cost, \$12,000.

Longport Drive road, gravel and stone, 3 miles; estimated cost, \$20,000.

Mays Landing and Tuckahoe road, gravel, 11 miles; estimated cost, \$11,000.

Egg Harbor City and Lower Bank road, gravel, 6 miles ; estimated cost, \$12,000.

Total number of miles, 32 ; total estimated cost, \$53,000.

BURLINGTON COUNTY.

Masonville and Coates Corner road, stone, 3.50 miles ; estimated cost, \$14,000.

Cross Roads and Green Tree, stone, 2.50 miles ; estimated cost, \$10,000.

Green Tree pike, stone, 2 miles ; estimated cost, \$8,000.

Ballenger's Mills and Indian Mills road, gravel, 6 miles ; estimated cost, \$7,200.

Medford and Tabernacle road, stone, 8 miles ; estimated cost, \$40,000.

Indian Mills, Atsion and Batsto road, gravel, 9.50 miles ; estimated cost, \$19,000.

Pemberton and Wrightstown road, stone, 6 miles ; estimated cost, \$24,000.

Columbus and Burlington road, stone, 7 miles ; estimated cost, \$28,000.

BURLINGTON COUNTY.

Burlington and Jacksonville road, stone, 6 miles ; estimated cost, \$24,000.

Burlington and Beverly road, stone, 3 miles ; estimated cost, \$12,000.

Mt. Holly and Jacksonville road, stone, 3.58 miles ; estimated cost, \$20,000.

Rancocas and Burlington road, stone, 4 miles ; estimated cost, \$16,000.

Charleston and Burlington road, gravel, 3 miles ; estimated cost, \$6,000.

Rancocas and Beverly road, stone, 5 miles ; estimated cost, \$20,000.

Crosswick's creek and Bordentown road, stone, 2 miles ; estimated cost, \$8,000.

Medford and Wilkins' Station road, stone, 1.50 miles; estimated cost, \$6,000.

Wrightstown and Rising Sun Square road, stone, 7 miles; estimated cost, \$24,500.

Keeler's corner and Jacksonville road, stone, 2 miles; estimated cost, \$8,000.

Tabernacle to Chatsworth, gravel, 10.50 miles; estimated cost, \$21,000.

Hartford to Bridgeboro road, stone, 3.3 miles; estimated cost, \$13,200.

Mount Holly and Smithville road, stone, 3 miles; estimated cost, \$12,000.

Bordentown and Groveville road, stone, 3 miles; estimated cost, \$12,000.

Bordentown and Wrightstown road, stone, 4 miles; estimated cost, \$16,000.

Bordentown and Florence Station road, stone, 5 miles; estimated cost, \$20,000.

Florence Station to city limits of Burlington, stone, 4 miles; estimated cost, \$16,000.

Wading River to Batsto, gravel, 9.59 miles; estimated cost, \$9,000.

Moorestown, Evesboro and Fellowship roads, stone, 6 miles; estimated cost \$24,000.

Total number of miles, 130.27; total estimated cost, \$437,900.

CAMDEN COUNTY.

River road, Pensauken Creek to Camden, stone, 5 miles; estimated cost, \$25,000.

Heading and Lawnside road, stone, 2.50 miles; estimated cost, \$12,000.

Sicklertown to Chew's Landing, gravel, 8 miles; estimated cost, \$9,600.

Haddonfield and Magnolia road, stone, 3.13 miles; estimated cost, \$15,389.

Haddonfield and Mt. Ephraim road, stone, 2.81 miles; estimated cost, \$17,866.

Total number of miles, 21.44; total estimated cost, \$79,855.

ESSEX COUNTY.

Roseland avenue, stone, 3.6 miles; estimated cost, \$15,834.

Parsonage road, stone, 3.5 miles; estimated cost, \$16,000.

East Passaic avenue and Center street, stone, 1.3 miles; estimated cost, \$6,667.

East Passaic avenue, stone, 2 miles; estimated cost, \$10,000.

Elizabeth avenue, stone, 1.3 miles; estimated cost, \$6,666.

Fairfield road, stone, 1 mile; estimated cost, \$5,000.

Eagle Rock road, stone, 3.5 miles; estimated cost, \$16,000.

Total number of miles, 16.2; total estimated cost, \$76,167.

GLOUCESTER COUNTY.

Cross Keys and Hurffville road, gravel, 5.41 miles; estimated cost, \$6,490.

Woodbury to Knight's Run school-house, gravel and stone, 5.26 miles; estimated cost, \$18,000.

Nortonville bridge to Swedesboro stone road, stone, 6 miles; estimated cost, \$24,000.

Mullica Hill road, gravel, 6.54 miles; estimated cost, \$7,434.40.

Bridgeport road, stone, 6.02 miles; estimated cost, \$23,700.

Glassboro and Clayton road, gravel, 5 miles; estimated cost, \$8,000.

Total number of miles, 34.23; total estimated cost, \$87,624.40.

MERCER COUNTY.

Whitehead's and Hutchinson road, stone, 2 miles; estimated cost, \$8,000.

Shabbakong road, stone, 3 miles; estimated cost, \$13,500.

Hightstown and York road, stone, 3.25 miles; estimated cost, \$14,625.

Allentown turnpike, stone, 3.45 miles; estimated cost, \$15,525.

White Horse and Crosswicks road, stone, 4 miles; estimated cost, \$18,000.

Hightstown and Long Branch extension, gravel, 2 miles; estimated cost, \$3,000.

Portion of Upper Ferry road, stone, 1.3 miles; township road; estimated cost, \$5,035.

Edinburgh and Hightstown road, stone, 6 miles; estimated cost, \$27,000.

Total number of miles, 25; total estimated cost, \$104,686.

MIDDLESEX COUNTY.

South Amboy and Sayreville road, stone, 6.5 miles; estimated cost, \$32,500.

Hightstown and Manalapan road, gravel, 2 ½ miles; estimated cost, \$4,000.

Highland Park and Bonhamton road, stone, 4 miles; estimated cost, \$18,000.

South Plainfield and Plainfield road, stone, 1.60 miles; estimated cost, \$6,500.

New Brooklyn and Mount Pleasant road, stone, 1.25 miles; estimated cost, \$5,000.

River road, New Brunswick, to Bound Brook, stone, 4 miles; estimated cost, \$16,000.

New Brunswick and Franklin Park road, stone, 5.50 miles; estimated cost, \$16,500.

Spotswood and Etinglishtown road, gravel, 2.50 miles; estimated cost, \$3,000.

Clifton avenue and Ryder's lane road, stone, 3.20 miles; estimated cost, \$14,400.

Old Bridge and New Brunswick road, stone, 4 miles; estimated cost, \$20,000.

Carteret road, stone, 1.6 miles, estimated cost, \$8,350.

Bound Brook and Lincoln road, stone, 2.28 miles; estimated cost, \$8,000.

Cranbury and Hightstown road, gravel, 1.33 miles, estimated cost, \$1,600.

Cranbury turnpike, stone, 8.01 miles; estimated cost, \$40,000.

Total number of miles, 48.39; total estimated cost, \$193,850.

MONMOUTH COUNTY.

Valley Drive, Atlantic Highlands and Navesink bridge road, stone, 2.85 miles; estimated cost, \$16,727.

Sweetman's lane to Tennent station, gravel and stone, 5.58 miles; estimated cost, \$10,044.

Lower Squankum road, gravel, 7.73 miles; estimated cost, \$13,914.

Holmdel and Bradvelt road, 3.5 miles; estimated cost, \$17,500.

Red Bank and Oceanic road, stone, 3 miles; estimated cost, \$12,000.

Brighton avenue and Long Branch, stone, 1.16 miles; estimated cost, \$7,934.30.

Kepyort and Keaburg road, stone, 3.33 miles; estimated cost, \$21,532.

Asbury Park and Farmingdale road, gravel, 9 miles; estimated cost, \$18,000.

Lakewood and Lower Squankum road, gravel, 5 miles; estimated cost, \$7,000.

Hightstown and Manalapan extension, gravel, 2 miles; estimated cost, \$3,000.

Total number of miles, 43.16; total estimated cost, \$127,651.30.

MORRIS COUNTY.

Stirling road, stone, 2 miles; estimated cost, \$10,000.

Williams' corner and Townley Bridge road, stone, 2.05 miles; estimated cost, \$10,528.

Whippany and Parsippany road, stone, 3.79 miles; estimated cost, \$20,044.

Succasunna road, stone, .81 mile; estimated cost, \$4,130.

Netcong and Budd's Lake road, stone, 4.59 miles; estimated cost, \$17,475.

Long Hill and Gillette road, stone, 2 miles; estimated cost, \$13,212.

Chester to D. L. & W. R. R. station, stone, .96 mile; estimated cost, \$4,915.

New Vernon road, stone, 2 miles; estimated cost, \$10,400.

Williams' corner and Passaic River road, stone, 3.15 miles; estimated cost, \$16,065.

Morristown and Mount Freedom road, stone, 5 miles; estimated cost, \$26,500.

Mendham to Somerset county line, stone, 2.40 miles; estimated cost, \$13,073.

Millington and Passaic River road, stone, 4 miles; estimated cost, \$20,000.

Total number of miles, 30.75; total estimated cost, \$166,342.

OCEAN COUNTY.

Long Beach road, gravel, 15 miles; township road, estimated cost, \$30,000.

Seaside Park road, gravel, 12 miles; estimated cost, \$24,000.

Total number of miles, 27; total estimated cost, \$54,000.

PASSAIC COUNTY.

Union avenue, stone, 2 miles; estimated cost, \$5,820.

Lackawanna avenue, stone, 2 miles; estimated cost, \$9,000.

Mortonhouse and Bergen County road, stone, 2 miles; estimated cost, \$10,000.

Midvale and Greenwood Lake road, stone, 10 miles; estimated cost, \$40,000.

Lakeside avenue at Pompton, stone, 1 mile; estimated cost, \$3,000.

Total number of miles, 17; total estimated cost, \$67,820.

SOMERSET COUNTY.

Bernardsville and Baskingridge road, 1 mile; estimated cost, \$4,000.

East Millstone and New Brunswick road, stone, 6 miles; estimated cost, \$21,000.

Somerville and Raritan road, stone, 2 miles; estimated cost, \$6,000.

Franklin Park and New Brunswick road, stone, 5.50 miles; estimated cost, \$16,500.

Dead River and Liberty Corner road, stone, 3.50 miles; estimated cost, \$12,250.

Millstone River and Rocky Hill road, stone, 1.50 miles; estimated cost, \$4,500.

Plainville and Cherry Valley road, 7 miles; estimated cost, \$24,500.

Passaic River, Smalleytown and North Plainfield township road, stone, 3 miles; estimated cost, \$10,500.

Baskingridge and Van Doren's Mill road, stone, 3 miles; estimated cost, \$12,000.

Somerville and New Jersey Turnpike road, stone, 6 miles; estimated cost, \$24,000.

Somerville to North Branch of Raritan River, stone, 9 miles; estimated cost, \$36,000.

Labaw's Corners and Rocky Hill road, stone, 4 miles; estimated cost \$16,000.

Liberty School-house and Conover's Corners road, stone, 3 miles; estimated cost, \$10,500.

Total number of miles, 54.50; total estimated cost, \$197,750.

UNION COUNTY.

New Providence and Passaic River road, stone, 3 miles; estimated cost, \$12,000.

Total number of miles, 3; total estimated cost, \$12,000.

SUSSEX COUNTY—TOWNSHIP ROADS.

Wantage township line and Sparta township line, stone, 7 miles; estimated cost, \$21,000.

Vernon township line and Sparta township line, stone, 3 miles; estimated cost, \$9,000.

Warwick and Newton road, stone, 4 miles; estimated cost, \$12,000.

Hardystonville and Passaic county line road, stone, 6 miles; estimated cost, \$18,000.

Total number of miles, 20; total estimated cost, \$60,000.

WARREN COUNTY.

Belvidere township road, stone, 2 miles; estimated cost, \$8,000.

Total number of miles, 2; total estimated cost, \$8,000.

Total number of miles of roads petitioned for in all the counties, 504.94; total estimated cost of all the roads petitioned for, \$1,726,644.70.



Ventnor and Longport Drive, Atlantic City.
Sand dunes and brush before improvement.



Ventnor and Longport Drive, Atlantic City.
4 inches of stone over 4 inches of gravel foundation. Built over heavy sand dunes, completing a fine drive the whole length of the Island.

DESCRIPTION OF ROADS IMPROVED IN 1899.

ATLANTIC COUNTY.

Longport Drive Road, 3 I-II Miles Long.

This road extends from the westerly curb-line of Portland avenue at Ventnor to Twenty-fourth street at Longport. It is built through beach sand dunes which have been graded, levelled and covered with gravel fifteen feet wide and six inches deep, carried from the main land. This is covered with trap rock, fifteen feet wide and four inches thick.

This road makes a broad avenue from Atlantic City to the steamboat landing at Longport, and gives a fine drive to the many thousand visitors of Atlantic City.

The contractors were Alvin P. Risley, Pleasantville, N. J., and the Delaware River Quarry and Construction Company, Lambertville, N. J.

The maximum grade is 0.24 per cent.

The total cost was \$22,618.77.

Chestnut Neck Road, Eight-elevenths of a Mile Long.

This road begins at the angle of road in Galloway township and extends to the draw-bridge over Mullica river. It is built of gravel, fourteen feet wide, eight inches thick at centre and slopes to six inches at side. It is a connecting link between the Mullica river road, built this year in Burlington county, and the series of improved roads built by the shore townships. It makes a continuous gravel drive along the coast from Lakewood to Atlantic City.

John Hanselman, Cologne, N. J., was the contractor.

The maximum grade was reduced from 1.80 per cent. to 95 per cent.

The total cost was \$1,846.39.

BURLINGTON COUNTY.

Farnsworth Avenue and Park Street, 1 3-5 Miles Long.

This road begins at the junction of Mill street with Farnsworth avenue and extends along Farnsworth avenue to Park street; thence along said street to Mile Hill Run, forming one of the last links in an improved road from Bordentown to Trenton. This road is built over a sandy loam formation, the soil of which is principally devoted to the raising of peas for canning. It is of macadam construction, sixteen feet wide and eight inches thick. The trap rock was from the Rocky Hill Quarries.

J. R. Shanley, Philadelphia, Pa., was the contractor.

The maximum grade was reduced from 8.7 per cent. to 7 per cent.

The cost per square yard was 52 cents.

The total cost was \$8,433.10.

Cross Roads and Ballinger's Mill Road, 3 6-7 Miles Long.

This road begins at the junction of the Lumberton and Medford road with the Vincentown and Merchantville macadam road, and extends in a southerly direction through the thriving village of Medford to Ballinger's Mills on the edge of the pine district. This road passes over a very fine farming district of sandy loam, black sand soil, through the pretty village of Medford to the commencement of the pine or sandy district. In the country the road is ten feet wide and six inches deep. In the town it is sixteen feet wide and six inches deep. The inhabitants have covered the balance of the main street with stone, thus making a broad and beautiful avenue. It is constructed of Rocky Hill trap crushed to two sizes, one and one-half to two and one-half inches, laid in two courses, each three and one-half inches thick and rolled to six inches.

Messrs. West and Manning, Trenton, N. J., were the contractors.

The maximum grade was reduced from 4.50 per cent. to 3.20 per cent.

The cost per square yard was 50 cents.

The total cost was \$12,741.96.

Burlington and Mount Holly Road, 5 1-4 Miles Long.

This road begins at Belmont street, in the city of Burlington, and extends to Wood Lane. It is built of macadam, fourteen feet wide and six inches thick. It extends through a very fine farming district, principally clay and gravelly loam, clay predominating. Upon each side of its course are many of the improved farms of Burlington county. It connects Mount Holly with Burlington city, the oldest town on the Delaware river, and makes a very fine drive and freight road for the thrifty farmers residing along and near to it and for the twelve thousand inhabitants of the cities of Mount Holly and Burlington. This should have been one of the first roads built in the county.

J. R. Shanley, Philadelphia, Pa., was the contractor.

The maximum grade was and is 3 1-2 per cent.

The cost per square yard was 43 cents.

The total cost was \$19,364.00.

Columbus and Bowne's Corner Road, Three Miles Long.

This road starts from Bowne's Corner, the center of a very fine agricultural district, passes by some of the finest and largest farms in Burlington county, over a sandy loam soil, to the heart of the thriving town of Columbus. It is built of macadam, six inches thick, fourteen feet wide in the town and ten feet wide in the country. The material is Rocky Hill trap, laid in two courses of two and one-half to one and one-half inch sizes.

E. L. Ragonnett, Rocky Hill, N. J., was the contractor.

The maximum grade was reduced from 7 per cent. to 4 1-2 per cent.

The cost per square yard was 52 cents.

The total cost was \$11,031.56.

Georgetown or Old York Road, 1 1-5 Miles Long.

This road begins at the edge of Bordentown and extends in a southeasterly direction over a clay and sandy loam farming dis-

tract towards the village of Georgetown. The balance of this road, about four miles, is to be completed next year.

It is built of macadam, ten feet wide and six inches thick, laid in two courses of two and one-half and one and one-half inch stone. It passes by some very fine large farms crowned with mansion houses, the size of which should indicate wealthy planters.

J. R. Shanley, Philadelphia, Pa., was the contractor.

The maximum grade was reduced from 3.4 per cent. to 2.9 per cent.

The cost per square yard was 48 cents.

The total cost was \$4,032.91.

Trenton Road, 1 4-5 Mile Long.

This road is a continuation of Farnsworth avenue and connects the northerly end of it with the Mercer county line at Crosswicks Creek. It is built of macadam, twelve feet wide and eight inches thick, of Rocky Hill stone. This road also passes over a sandy loam district, and is part of a complete stone road from Bordentown to Trenton over which a large amount of traffic is daily passing.

George Banchoff, Jr., Lambertville, N. J., was the contractor.

The maximum grade was reduced from 7 per cent to 4.8 per cent.

The cost per square yard was 49 cents.

The total cost was \$8,124.10.

Mullica River Road, 1 3-4 Miles Long.

This road runs from the main land across the Mullica river meadows to the Mullica river bridge, making a connecting link between the gravel roads of the shore district of Burlington county and that of Atlantic county, forming a continuous gravel road from Long Branch to Atlantic City. On this line are seventeen bridges, two of them drawbridges.

Its construction is of gravel fifteen feet wide and six inches



Old York Road,
Burlington county, 6-inch macadam. After improvement. Bearing heavy traffic.



Old York Road,
Burlington county, leading from Bordentown towards Georgetown, 6-inch macadam. After.

thick. This was thoroughly rolled and covered with oyster shells fifteen feet wide and six inches thick, and then covered with two inches of gravel, which is proving a great protection to the shells from the heavy tides and strong winds that sweep over this vast expanse of meadows.

Charles W. Mathis was the contractor.

No grade on this road.

The cost per cubic yard for gravel was 45 cents.

The cost for shells was 9 cents a bushel.

The total cost was \$5,447.21.

CAMDEN COUNTY.

Park Avenue, 2 1-50 Miles Long.

This road is constructed of macadam, fourteen feet wide and eight inches thick, from the Goat Hill Quarries along the Delaware river near Lambertville. It passes through the borough of Merchantville in a southwesterly course to Pensauken creek, running parallel with the Camden and Burlington County Railroad. The most of its line is dotted with residences and villa sites. It makes a hard road connection for the fruit and truck sections south of Merchantville with the pikes leading towards Philadelphia.

J. R. Shanley, Philadelphia, Pa., was the contractor.

The maximum grade was reduced from 4.6 per cent. to 3.7 per cent.

The cost per square yard was 77 cents.

The total cost was \$13,850.55.

Massey Avenue, Five Twenty-fourths of a Mile Long.

This road, twelve feet wide, is a connecting link between two other improved roads west of Collingswood. It is built of telford, eight feet in the center, and macadam wings six inches deep, each two feet wide. Telford bottom five inches thick, covered with five inches of macadam.

Walter Ireland was the contractor.

The maximum grade was and is 1 per cent.

The total cost was \$1,386.00.

ESSEX COUNTY.

Franklin Avenue, Three-fifths of a Mile Long.

There were five hundred and twenty-eight feet of this road built last year at a cost of \$663.75—the balance finished this year. The road begins at the Morris Canal bridge in the township of Bloomfield and extends in an easterly direction to Jeroloman street. It is built of telford macadam, sixteen feet wide and eight inches thick, and extends over a tiller clay soil. It is a continuation of one of the improved streets of Bloomfield.

Mr. Robert Wright and Mr. Stuart Lindsley, Orange, N. J., were the contractors.

The maximum grade was reduced from 13.8 feet in one hundred to 5.2 feet in one hundred.

The cost per square yard was 49 cents.

The total cost was \$4,587.06, of which \$663.75 was paid last year.

Broad Street, 2 7-8 Miles Long.

This road begins at Bay Avenue, in the township of Bloomfield, and extends in a northerly direction to the county line. It is built of telford macadam, sixteen feet wide and ten inches thick. It passes over a stiff, clay, glazier drift; fence boulders were used in the bottom and local trap for the surface.

Francis J. Marley was the contractor.

The maximum grade was reduced from 4.77 per cent. to 3.92 per cent.

The cost per square yard was 41 cents.

The total cost was \$15,788.05.

Bay Avenue, Six-elevenths of a Mile Long.

This is a short street connecting the avenues of Glen Ridge and Broad street, Bloomfield. It is of boulder telford-construction and is sixteen feet wide and eight inches thick. It passes over a heavy, till, clay soil.

Messrs. James H. and Sherman G. Francisco were the contractors.

The maximum grade was reduced from 9.25 per cent. to 7.10 per cent.

The cost per square yard was $39\frac{1}{2}$ cents.

The total cost was \$4,395.15.

Mount Hebron Road, 1 Mile Long.

This road extends from Valley road, Montclair, to Broad street, Bloomfield. It is constructed of boulder telford foundation sixteen feet wide and five inches thick, macadam surface, sixteen feet wide and three inches thick. It extends through an improved section of Bloomfield, on each side of which many new improvements are being made. It passes over a stiff, clay, till, glacier, drift.

The Osborne and Marsellis Company were the contractors.

The maximum grade was reduced from 14.13 per cent. to 7.92 per cent.

The cost per square yard was 38 cents.

The total cost was \$6,195.01.

Watchung Avenue, 1 1-2 Miles Long.

This road begins at Upper Mountain avenue, Montclair, and extends to Broad street, Bloomfield. It is built of trap rock, sixteen feet wide and eight inches thick. Five inches of boulders in the bottom, and three inches of macadam on the top. It connects the avenues of the towns of Montclair and Bloomfield. It passes over a stiff, clay soil, not many boulders.

The Forman Stone Supply Company were the contractors.

The maximum grade was reduced from 12.25 per cent. to 12.16 per cent.

The cost per square yard was 40½ cents.

The total cost was \$10,407.48.

Bloomfield Avenue, 1 1-2 Miles Long.

This road is constructed of telford, sixteen feet wide and five inches thick, covered with macadam, sixteen feet wide and three inches thick. The telford is built of local boulders and the macadam from the outcropping ledges of the surrounding country. This road is a continuation of Bloomfield avenue to the county line at Passaic river, and there connects with the Denville and Pine Brook road in Morris county, this year finished. This makes a through line from Newark over Bloomfield avenue and the Morris county macadam roads to Lake Hopatcong. This is one of the most important connections made in the county and State during the past year, and forms a fine avenue of travel for the immense population east and west. A trolley line is being constructed along the line of this road, which is at present built nearly to the county line.

Messrs. James H. and Sherman G. Francisco were the contractors.

The maximum grade was reduced from 6.78 per cent. to 6.48 per cent.

The cost per square yard was 43 cents.

The total cost was \$8,622.64.

Fairfield Road, Four Miles Long.

This road extends from Bloomfield avenue north to the north-western part of Essex county. It is constructed of telford, sixteen feet wide and five inches thick, covered with macadam, sixteen feet wide and three inches thick. The telford was constructed from the boulders that were in the fences and scattered over the surface of the soil. The macadam is of trap rock crushed from the local ledges jutting out in that section of the country. It passes through the Passaic River valley over alluvial deposits formed from the overflow of the Passaic river, and the washings from the surrounding hills. It gives a very fair

farming section a fine outlet to the Newark and Orange markets over roads already graded to those points, also connects the macadam system of Essex county with that of Passaic and Morris counties.

Messrs. James H. and Sherman G. Francisco were the contractors.

The maximum grade was reduced from 3.28 per cent. to 2.42 per cent.

The cost per square yard was 44 cents.

The total cost was \$19,988.66.

GLOUCESTER COUNTY.

Franklinville Road, 6 Miles Long.

This road extends from the Clayton borough's line over the old Malaga turnpike through Franklinville and Malaga to the Cumberland county line. It completes the system of improved roads all the way from Camden down to the Cumberland county line. It is built of gravel, laid in two courses, fourteen feet wide and six and eight inches thick. The land over which it passes is a sandy loam, sand predominating. Part of the road runs through an improved country, the lower portion over land that is covered with timber. It affords a fine outlet for the inhabitants of this section to the northern markets, and is a portion of what will eventually be an improved line through Cumberland county and Vineland to the seashore at Cape May.

It is a very pretty gravel road and has added a great deal to the appearance of the surrounding country.

Quinlan & Leary, South Amboy, N. J., were the contractors.

The maximum grade was reduced from 4.10 per cent to 2.20 per cent.

The cost per cubic yard for compacted gravel was 34 cents.

The total cost was \$9,061.16.

Cross Keys and Hurffville Road, 5 2-5 Miles Long; 3 1-33 Miles built this Year.

This road extends from the village of Cross Keys to the stone road at Hurffville. It is constructed of local gravel, fourteen feet wide and seven inches thick. It passes over a sandy loam country, sand predominating, along the line of which there are some very fine and some very poor farms, the productions of which seek a market towards Camden. Several very fine beds of gravel have been found along the line of this road, making it an inexpensive road to maintain as well as build.

William O. Garrison, Bridgeton, N. J., was the contractor.

The maximum grade was reduced from 2.1 per cent. to 1 per cent.

The total cost was \$5,091.29.

Woodbury and Knight's Run Road, 5 1-4 Miles Long; 1 1-2 Miles completed this Year.

This road extends from German street, in the city of Woodbury to Knight's Run. It is built of gravel, fourteen feet wide and eight inches thick. On this road gravel was placed to a depth of one foot and compressed to eight inches. It was an expensive road to build, costing almost as much as stone roads do in some counties, on account of the heavy grades and the scarcity of the gravel beds. One and one-half miles were built of stone on account of the scarcity of the gravel.

It forms a very nice connection for the inhabitants of this part of the country, who are largely engaged in trucking, to Woodbury and the markets farther north. The soil is sandy loam, with the exception of two miles which is heavy clay. The subsoil was difficult to drain.

Quinlan and Leary, South Amboy, N. J., were the contractors.

The maximum grade has been reduced from 5.05 per cent. to 2.25 per cent.

The total cost was \$4,852.22.





White Horse Road,
Mercer county, entering Trenton, 4-inch macadam, bearing heavy traffic.



Pennington and Trenton Road,
Mercer county, 6 and 8-inch macadam, bearing heavy traffic.

Broad Street, Woodbury, 4-5 of a Mile Long.

This road extends northerly through the village of Woodbury. It ranges in width from ten to fifteen feet and is eight inches thick. It is constructed of trap rock from the Goat Hill Quarries on the Delaware river. The citizens of the borough have joined with the State and county and covered the whole street with stone, making a very pretty macadam road over the whole street. It connects on either end with improved roads, and helps to form continuous lines north and south through other portions of the county.

J. Roosevelt Shanley, Philadelphia, Pa., was the contractor.

The maximum grade before was 4 per cent. Maximum grade now is 4 per cent.

The cost per square yard was 50 cents.

The total cost was \$6,878.43.

MERCER COUNTY.

Pennington Road, 6 3-4 Miles Long.

This road commences at the city line of Trenton and extends to the borough line of Pennington. It is constructed of macadam, fourteen feet wide and six and eight inches thick. It extends over the bed of an old turnpike on clay and clayey loam and red shale soils, and through a very fine farming section improved on each side with handsome farm buildings. This road fills a long felt want for a continuously improved line all the way from Trenton through Pennington to Hopewell, and part of a trunk line from Trenton to Somerville, all of which is being built by sections in the two counties. This road should have been among the first to be constructed, but being a toll pike it has not until lately been in a position where the freeholders could control it, so other lines were first built nearly parallel to it which have not filled the purpose of making direct trunk lines. The grading of this road was light on account of previous preparation by the turnpike company. It furnishes a short line for a large and popu-

lous farming district and for several towns of considerable size to the fine markets and stores of the great manufacturing city of Trenton.

Charles Staats, Bound Brook, N. J., was the contractor.

The maximum grade was reduced from 4.2 per cent. to 3.46 per cent.

The cost per square yard was 57 cents for eight inch macadam and 48 cents for six inch macadam.

The total cost was \$37,998.77.

Asylum Road, 3 Miles Long.

This road extends from Parkside avenue, Calwalader Place, by the New Jersey State Lunatic Asylum to Birmingham. It is constructed of trap rock macadam, fourteen feet wide and six inches thick. It extends over an alluvial and drift formation. This road forms an outlet for the people of Trenton north towards the junction of the Bound Brook road to a section that is being rapidly improved with resident sites; also to the towns of Woodsville, Lambertton and Titusville.

Robert A. Montgomery, Lambertville, N. J., was the contractor.

The maximum grade was reduced from 6.2 per cent. to 5.35 per cent.

The cost per square yard was 44 cents.

The total cost was \$11,150.85.

Upper Ferry Road, 1 1-6 Miles Long.

This road is a continuation of the Asylum Road and extends from Birmingham to the Delaware and Raritan Canal. It is constructed of macadam, twelve feet wide and six inches thick. It extends over an alluvial and sandy loam soil through and to rapidly improving sections. This, in connection with the Asylum road, forms a very pretty drive to the northwestern part of the county.

Robert A. Montgomery, Lambertville, N. J., was the contractor.

The maximum grade was reduced from 6 to 5 per cent.

The cost per square yard was 42 cents.

The total cost was \$3,706.08.

MIDDLESEX COUNTY.

Cranbury Road, 2 1-5 Miles Long.

This road extends from the Institute in Cranbury to Cranbury Station. It is constructed of trap rock macadam, twelve feet wide and eight inches thick.

This road passes over a well improved farming section, composed principally of rich, sandy loam soil. Very fine farms are located along the line of this road, and it affords an outlet for the residents of the beautiful village of Cranbury to the station on the Cranbury and Amboy Road.

R. A. Montgomery, Lambertville, N. J., was the contractor.

The cost per square yard for 8-inch macadam was 49 cents.

The maximum grade was reduced from 4 per cent. to 1 1-2 per cent.

The contract lump sum was \$7,650.00.

The total cost was \$9,602.96.

George's Road, 4 2-3 Miles Long.

This road commences at Bodine's Corner and extends in a southwesterly direction to Black Horse Brook. It is built of trap rock macadam, twelve feet wide and eight inches thick. It runs through a good farming country and is part of a continuous line which we expect to build next year from New Brunswick through Cranbury to Hightstown. The road is a bed of an old turnpike which at one time had great travel. It will supply a very extensive farming section with a fine outlet to the New Brunswick and other northern markets. It forms part of a trunk line from the northern to the southern portion of the State.

R. A. Montgomery, Lambertville, N. J., was the contractor.

The maximum grade was reduced from 4 per cent. to 3 per cent.

The contract lump sum was \$17,640.18.

The total cost was \$18,487.23.

Bound Brook and Lincoln Road, 2 1-4 Miles Long.

This road extends from Bound Brook to Lincoln road near Dunellen. It is built of macadam, twelve feet wide and eight inches thick. This road completes the system of roads from Somerville through Bound Brook to Plainfield. It fills the only link in a trunk line east and west from Somerville through Bound Brook to the cities on the eastern borders of the State. It extends through a fine farming and manufacturing district which is rapidly developing.

J. J. Hillpot, Bound Brook, N. J., was the contractor.

The maximum grade has been reduced from 3 per cent. to 2 per cent.

The cost per square yard was 55 cents.

The total cost was \$6,058.00.

Old Bridge Road, 7 1-8 Miles Long; 3 Miles to be built this Year.

This road extends from the city of New Brunswick to Old Bridge. It is constructed of macadam, twelve feet wide and eight inches thick. It extends over the bed of an old, wornout, gravel turnpike, over a sand and sandy loam soil, through a fine farming section. It forms part of a continuous line from New Brunswick to the seashore at Long Branch, connecting at Old Bridge with the Old Bridge and Matawan State stone road.

J. R. Shanley, Newark, N. J., was the contractor.

The maximum grade was reduced from 7 per cent. to 5 per cent.

The cost per square yard was 73 cents.

The total cost of three miles built this year was \$15,417.60.



Navesink and Hillside Road,
Monmouth county. Before improvement.



Navesink and Hillside Road,
Monmouth county. After improvement.

MONMOUTH COUNTY.

Navesink and First Avenue and Hillside Road, 2 1-2 Miles Long.

This road begins at the Stone Church in Navesink and extends northeast to Walter Maxon's Hill, with a branch connection at Mr. Swain's store, and extending east and north to Valley Drive in Atlantic Highlands. It is built of two kinds of local gravel, fourteen, sixteen and twenty feet wide and six and seven inches thick. This mixture of clay gravel with a gravel rich in stones makes an apparent hard surface for all kinds of wear and weather. The road passes over portions of two streets of the village of Navesink to the outlying edges of Atlantic Highlands. It makes a very substantial and pretty drive for the permanent residents and numerous pleasure seekers, composed, principally, of summer visitors to this picturesque region.

Jonathan F. Stout, Middletown, N. J., was the contractor.

The maximum grade was reduced from 8.50 to 7.10 per cent.

The price per cubic yard for compacted gravel was 7 1-2 cents.

The total cost was \$5,270.12.

Atkins Avenue, 2 Miles Long.

This road begins at Summerfield avenue, in West Asbury Park, and extends to Shark river. It is constructed of Allenwood gravel, nine inches thick, compressed to six inches. It is sixteen feet wide.

This avenue forms a connection between Asbury Park and Shark river, and will relieve the congestion of travel on the main road between those two points. It is built through a newly-developed district, that is being rapidly covered with dwellings.

Alexander Mullen, Neptune City, N. J., was the contractor.

The maximum grade was and is one per cent.

The contract lump sum price was \$3,942.00.

The total cost was \$4,191.00.

Sweetman's Lane and Tennent Station Road, 2 2-3 Miles Long.

This road extends from Sweetman's Lane through Millhurst to the Tennent Station. It is constructed of macadam, ten feet wide and six inches thick. It extends through a very fine farming district, over a hilly and sandy loam country, and affords a fine outlet for the productions of the numerous prosperous farmers that live along the line of the road, and for the products of Snyder's Mill, which does the largest milling business of any mill in the county. The first intention was to build this of gravel, but on account of the heavy travel over it it was thought the better part of wisdom to construct it of stone.

Willam H. DuBois, Freehold, N. J., was the contractor.

The maximum grade was reduced from five to three per cent.

The cost per square yard for macadam was 64 cents.

The total cost was \$1,700.00.

Red Bank and Eatontown Road, 3 Miles Long.

This road is constructed of telford, fourteen feet wide and ten inches thick, covered with macadam, fourteen feet wide and eight inches thick. It extends from the thrifty and rapidly growing town of Red Bank to Eatontown. The farms along the line are giving way to handsome residences and villa sites.

This road forms one of the connecting links between a system of roads running from the northern part of the State through New Brunswick, Old Bridge and Matawan to the seashore; also a connecting link between Long Branch and Asbury Park. When this is finished it will make a continuous stone road from Red Bank through Eatontown, Long Branch, Elberon and Asbury Park to Belmar, a distance of about fifteen miles.

The soil is a sandy loam, in which clay predominates. In some parts of it there are heavy bodies of clay. It is a fine farming district.

William C. Shanley was the contractor.

The maximum grade was reduced from 3 1-2 per cent. to 2 1-2 per cent.



Denville and Pine Brook,
Morris county. Before.



Denville and Pine Brook,
Morris county. After. 6-inch macadam.

The cost per square yard was 75 cents for eight inch macadam and 85 cents for ten inch telford.

The total cost was \$23,485.31.

Lower Squankum and Turkey Road, 4 1-2 Miles Long.

This road is constructed of gravel, fourteen feet wide and nine inches deep. It extends through an almost level country, slightly rolling. There was very little grading. The soil is a sandy loam. The most of it is a very good farming country, much material being raised along the shore for marketing. This is part of an improved line from the county seat at Freehold to Manasquan and the lower seaside resorts of Monmouth county.

James H. Butcher, Ardena, N. J., was the contractor.

The maximum grade was reduced from 4.26 per cent. to 2.83 per cent.

The cost per cubic yard for compacted gravel was 55 cents.

The total cost was \$8,550.55.

MORRIS COUNTY.

Denville and Pine Brook Road, 7 Miles Long.

This road begins at Denville, in the northwestern part of the county, and extends in a southeasterly direction to Pine Brook, on the boundary line of Morris and Essex counties. It is built of macadam, twelve feet wide and six inches thick.

This road extends mostly over a fine agricultural district. At the western end the land is wild and covered with timber. Several small towns are located along the line of this road. In connection with the Essex county system and the Morristown and Hopatcong macadam road it makes a continuous line of improved highway from Lake Hopatcong to the city of Newark, a distance of over thirty miles.

The contractors were Augustus Munson & Co.

The maximum grade was reduced from 14 per cent. to 10 per cent.

The cost per square yard for macadam was 41 cents.

The total cost was \$29,119.88.

Hanover and Afton Road, 2 1-7 Miles Long.

This road is a continuation of the Madison and Afton road to the Essex county line. It forms connections with the improved macadam system of Morris and Essex counties, making continuous lines from several points in Morris county to and through Essex county. It is built of macadam, twelve feet wide and six inches thick. It extends through a fine farming district, over sandy loam and alluvial soils. There are small towns along its line.

Messrs. Daniels and Stanley were the contractors.

The maximum grade was reduced from 7 per cent. to 4 per cent.

The cost per square yard for macadam was 45 cents.

The total cost was \$8,644.65.

Rockaway and Hibernia Road, Eight-ninths of a Mile Long.

This road begins at Rockaway and extends to Hibernia Railroad crossing. It is constructed of macadam, sixteen feet wide and six inches thick. It extends through Rockaway, a thrifty manufacturing town, over a soft alluvial soil, by many new dwellings and fine improvements. The celebrated Hoagland Stone Crushers are made there. Large snuff mills are also located there.

Dickerson & Gill, Rockaway, N. J., were the contractors.

The maximum grade was reduced from 8 per cent to 6.5 per cent.

The cost per square yard was 41 1-2 cents.

The total cost was \$6,072.14.

PASSAIC COUNTY.

Midvale Road, 4 Miles Long.

This road begins at Pompton, on the Paterson and Hamburg turnpike, and extends to Midvale on the road to Greenwood Lake. It is built of macadam, sixteen feet wide and four inches thick.

This road is a portion of the main line of travel from Paterson to Greenwood Lake. It extends along a beautiful valley, through several small towns, and over a fine farming district. The land is principally a drift and alluvial formation. The bastard trap rock of which it is built is mined in the vicinity. It is contemplated to continue this line to Greenwood Lake.

Messrs. Colfax and Steele were the contractors.

The maximum grade was reduced from 5 per cent. to 2 per cent.

The cost per square yard for macadam was 20 1-2 cents.

The total cost was \$11,926.78.

Milton Road, 1 2-3 Miles Long.

This road extends from the Oak Ridge Station, N. Y. S. & W. R. R., to the bridge at the Oak Ridge reservoir. It is built of macadam, sixteen feet wide and four and six inches thick.

This road extends along the base of picturesque mountains, along and above the beautiful Long Wood Valley, a fine farming and grazing district. A large part of the mountain section is utilized as a water shed for the East Jersey Water Company. It is a detached link which is soon to be connected with the Paterson and Hamburg turnpike. The grades were heavy and the cuts and fills were deep, requiring from ten to twelve feet of excavation through the hills. This improvement gives the inhabitants an easy outlet to the station. The soil over which the road passes is principally composed of glazier drift, decayed granite and gneiss underlaid with shale. Boulders abound over the whole surface.

Messrs. Colfax and Steele were the contractors.

The maximum grade was reduced from 15 per cent. to 7 per cent.

The price per square yard was 20 and 27 cents.

The total cost was \$8,984.50.

Mountain View and Singac Road, 2 Miles Long.

This road is principally built on a crest of a trap mountain through a wild section which is mainly valuable for resident sites, of which a number have been and are being built. It was principally constructed to develop a very picturesque section south of Paterson. It is built of macadam, sixteen feet wide and four inches thick.

The Preakness Crushing Company were the contractors.

The maximum grade was reduced from 10 per cent. to 8 per cent.

The cost per square yard was 16 cents.

The total cost was \$5,980.00.

Great Notch Road, 1 Mile Long.

This road makes a connecting link between the Long Hill and the Notch road in Little Falls township. It extends through a picturesque valley that is principally utilized by the New Jersey Water Company for laying a portion of their immense system of pipes. It is built of trap rock, sixteen feet wide and four inches thick.

Wright & Lindsley were the contractors.

The maximum grade was reduced from 8 per cent. to 6 per cent.

The cost per square yard was 28 cents.

The total cost was \$6,194.79.

SALEM COUNTY.

Hancock Bridge Road, 2 1-6 Miles Long.

This road extends from Hancock Bridge to the dividing line of the townships of Elsinboro and Alloway Creek. It was built of oyster shells, ten feet wide and six inches thick, the shells placed twelve inches deep and rolled to six inches. One hundred thousand bushels of oyster shells were used in its construction. The shells form a very pleasant road, which gives an outlet to-



Mine Brook Road,
Somerset county, rock bottom, 6 inches thick, surface 4 inches thick.



Mine Brook Road,
Somerset county. After. Through heavy cut. Rough rock bottom, 6-inch, faced
with 4-inch macadam.

wards Salem for a very well developed farming district, the soil of which is principally clay and sandy loam.

Herschel Mulford, Millville, N. J., and Eleazar Smith, Salem, N. J., were the contractors.

The maximum grade was reduced from 1 per cent. to 3 per cent.

The total cost was \$5,179.76.

SOMERSET COUNTY.

Mine Brook Road, 6 3-5 Miles Long.

This road begins at the north branch of the Raritan river, near Bedminster, and extends to the Passaic river near Van Doren's Mills. It is built of rock and macadam, rock twelve and fourteen feet wide and six inches thick, covered with macadam twelve and fourteen feet wide and four inches thick. It is a continuation of a road built from Morristown to the Somerset county line, over a well developed farming district and in a section which is being rapidly settled by the millionaires of New York City. It not only affords an outlet for the farmers of this section, but a fine drive for those who are rapidly acquiring the soil of this section for summer homes. It is a link in the line which is intended in the near future to complete from Morristown to Somerville, making one of the finest and most picturesque drives in the State.

The Osborne and Marsellis Company were the contractors.

The maximum grade was reduced from 12.8 per cent. to 8.14 per cent.

The cost per square yard for ten-inch rock road was 56 1-2 cents.

The total cost was \$32,194.47.





Broad Street,
Bloomfield, Essex county. Laying boulder, telford and macadam.



Broad Street,
Essex county, 5-inch boulder telford. 3-inch macadam surface.

ROAD BUILDING IN NEW JERSEY FOR THE YEAR 1899

The increased appropriation from \$100,000 to \$150,000 for State aid to public roads by our last Legislature has enabled us to largely increase our mileage during the past year, having built thirty-one miles more than in 1898. The construction in '95 was about forty-six miles; in '96 about fifty miles; in '97 seventy miles; in '98 eighty-five miles, and in '99 one hundred and sixteen miles. The cost per mile this year has been somewhat greater than last on account of the higher price of labor and stone and the delay in obtaining cars to carry the stone from the quarries to the lines of work. In all parts of the State to which stone has to be conveyed by railroads the contractors have been hampered the whole season for the want of transportation. This has prevented the completion of a number of contracts within the specified time, and leaves some roads unfinished at the end of the fiscal year. The desire for these roads has not in anywise decreased. The counties that have been building are continually injecting new roads, thus keeping about the same number of miles petitioned for ahead of the appropriation. The increased donation by the State of \$50,000 has enabled some of the most enterprising counties to build as many miles as the limit of law, one-fourth of one per cent. tax on their ratables, will allow; while other counties have petitioned for many miles of roads, their governing bodies confine their construction to a fixed number of miles each year and for all of the above we have approved either to the limit of the law or to the desire of the freeholders. A few counties having a large amount of ratables build all the mileage your Commissioner will approve of. There are some counties with governing boards that will not accept any of the petitions presented to them. For these the mandamus clause would

be particularly applicable, for the experience has been that when only one State road is built in a county others quickly follow.

THE TOWNSHIP STATE AID LAW.

To correct this condition by allowing portions of the county to obtain hard roads where their freeholders would not accept petitions for same, the Legislature, last March, passed what is called the Township State Aid Act, which allows the property holders to petition the governing bodies of townships in the same manner as they now do the county officials. By this law the property holders agree to pay ten per cent. for the special benefits conferred, the State pays one-third less the ten per cent. and the township 67 per cent. By this process the improvement remains a township road, and the township is required to forever keep it in repair. Under this law there have been specifications prepared and approved of for five separate lines. Residents of Hardyston township, in Sussex county, petitioned for three small pieces under this act; in Belvidere, Warren county, one small piece; in Ewing township, Mercer county, one of one and one-half miles in length. These specifications were all approved of by your Commissioner, but only one road in Belvidere, Warren county, was built. The bids on the roads in Sussex county were higher than the township committees thought they were justified in paying for; consequently, the bids were not accepted and the roads have not as yet materialized. The road in Ewing township, Mercer county, has been contracted for but will not be constructed until next year. By another year, when this Township Act is fully understood by the people, there will probably be under it more applications for roads.

The building of the small piece in Belvidere has so impressed the citizens with their desirability that they are preparing to build two miles more under it next year.

CONTINUOUS LINES.

In the furtherance of the idea of continuous lines throughout the State we are making very good progress. A road seven miles in length has been built in Morris county running northwest and southeast, connecting with another piece built in Essex county, which makes a continuous line from Newark to Lake Hopatcong. We have also completed a link from Afton to Hanover which connects Chatham and Madison and several points in the Morris county system with several roads in the Essex county system, making several continuous lines from Morris county to the Oranges.

A road has been approved of in Middlesex county, seven miles in length, between New Brunswick and Old Bridge, which, with other improved roads, makes a continuous line from New Brunswick to Long Branch and the more southern portions of the seashore. Another road is also in the course of construction from New Brunswick through Dayton and Cranbury to the Mercer county line, fifteen miles long. This connects with a road which has been approved of leading from the Mercer county line south through Hightstown and Windsor to Edingburgh, giving an improved highway all the way from New Brunswick to Trenton, thence to Jersey City. Three small pieces of roads have also been approved of from Hightstown through the counties of Mercer, Middlesex and Monmouth, which gives improved roads all the way from Trenton through Freehold to Long Branch. The last link in the system between Camden and Trenton has been this year completed from near Bordentown to the Crosswick's Creek at Mercer county line. We are also extending several lines from large centers towards other business centers by adding a link each year to their respective ends. Of this class is the road from Morristown through Bernardsville towards Somerville, six miles of which has been completed this year to Bedminster. A link of seven miles in the chain from Trenton through Pennington and Hopewell to Somerville has been constructed this year. We have now four lines pointing northward

from the city of Trenton, to which additions will probably be added each year, connecting Trenton with the improved towns that lie northeast, north and northwest from this great manufacturing and merchandising center.

The roads leading out of Camden are being gradually added to until they now resemble a wheel with many spokes, the rim of which is continually expanding. In the southern part of the State the important towns of Bordentown, Columbus, Burlington, Beverly, Mt. Holly, Moorestown, Gloucester, Woodbury, Paulsboro and Egg Harbor City have now several roads improved by State Aid and leading in different directions long distances into the surrounding country. In the northern portion of the State Trenton, New Brunswick, Metuchen, Perth Amboy, Rahway, Plainfield, Bound Brook, Newark, Paterson and Morristown have similar hard roads radiating in all directions. Essex county, still ambitious for all the State aid it can get, has almost a perfect network of improved roads running in every direction over its surface. Although several side lines not so important have been forced through local influence into the improved list, yet we can rest well satisfied with our progress in the direction of continuous lines. If the same idea continues to materialize for a few years, automobiles will be able to travel on smooth surfaces over all the desirable portions of this State.

CONSTRUCTION.

In the composition of our roadbeds in all specifications prepared by the State, believing that a better and more permanent road will result from the sole use of stone, we have aimed to keep out of the roadbed all material except stone and stone screenings, and have mainly succeeded in so doing in most of the southern counties of the State. In the northern counties where they have been building for a greater number of years the engineers are warm advocates for and still insist upon the use of more or less loam as a binder to the stone. The use of dirt of various kinds may not be detrimental if applied in very small quantities, as the stones more quickly come to a repose than where it is not used, and thus saves the contractor much time;

but when they are allowed to use small quantities, it frequently results through carelessness of workmen or otherwise that too much is placed in the heart of the road, making a filler of it instead of a binder; consequently, in wet weather it absorbs moisture, softens the roadbed and allows movement of the stone until traffic drives it to the surface and makes a surface of mud in the place of what should be stone. We believe there is no absolutely certain way to obtain a perfectly pure and solid stone bed except by the application of only stone binder; but as, according to the law, the freeholders and their engineers can prepare the specifications, we are in a measure forced to accede to their requests. As the counties will be responsible for the maintenance of the roads and as the freeholders so thoroughly believe they can better construct with the use of dirt binder, we have not withheld our signatures from specifications so prepared. Binding material to produce the best results should be equal in hardness and toughness with the road stone; the best results are therefore obtained by using screenings or spalls from the broken stone used. Coarse sand or gravel can sometimes be used with impunity as a binder, but the wisdom of using loam or clay is very much questioned. When the latter material is used for a binder the road is apt to become very dusty in dry weather, and sticky, muddy and rutty in wet weather. We have educated several of the governing bodies of our counties to believe they will obtain more lasting results by the use of only stone screenings for binder, and hope in time to see the practice adopted by all the counties of the State.

TROLLEY LINES.

Although we have been somewhat exercised about the building of trolley lines alongside of or on our improved roads, their progress in that direction this last year has not been very marked. They have not as yet occupied more than twenty miles of our State Aid highways, and on most of these they have been forced to build alongside of instead of the centre of the roadway, so have not destroyed the integrity of our stone beds. Although these lines are a menace to spirited horses, yet their building has been encouraged by the adjacent property owners and residents, those who

would be the most affected by accidents resulting from the fright of horses.

STEAM ROLLING VERSUS HORSE ROLLING.

Rollers drawn by horses are not satisfactory for compacting broken stone or gravel roads. They are also expensive to use, and if weight exceeds five tons they are not used on steep grades.

A horse roller weighing five tons has a face of five feet and of course the whole weight of 10,000 pounds is carried upon the face of the 60 inches, and if the contact with the ground is 1 inch in width, then the whole weight will be born by a strip 60 inches long and 1 inch wide, making the pressure for one square inch about 167 pounds.

The hoofs of the horses must displace the loose material which it is desired to roll, and the weight per square inch exerted by one horse is as great and sometimes greater than that exerted by the roller. This great drawback to horse rollers necessitates many more passes backwards and forwards than would be required if the roller were self-propelling.

A steam roller on the other hand is self-propelling, and the action of the driving wheels is such as to compress the material and not displace it. Further, steam rollers are made to carry much greater weight on the driving wheels, the compression exerted varying from 400 pounds to 700 pounds per square inch. In operation, the steam roller moves equally well backwards or forwards, so that there is no time lost in turning at each end of the section, as must be the case with horses; the machine is controlled entirely by one man, who merely reverses his engine at the ends of the section and steers his machine gradually and easily over the whole surface; in fact with a steam roller, four or five times the surface can be covered in the same time as can be covered with the horse roller. Also the compression is from three to four times as great, which must necessarily make a better road. Horse rollers can not be worked at all on steep grades, whilst the steam roller will do good work on a grade of 16 per cent.

If the cost of operation be taken into consideration, the result is very much in favor of steam rollers. It is true that a steam

roller costs much more money than a horse roller. The average horse roller costs about five hundred dollars (\$500), and the average steam roller about four thousand dollars (\$4000), but the steam roller can be operated for at least four dollars per day less than the horse roller. If in use 150 days in the year, the saving in operation would be six hundred (\$600), and the steam roller will do four times as much work as the horse roller, besides doing it three or four times as well. Now if the steam roller will do four times as much work as the horse roller, in addition to the saving of six hundred dollars (\$600) difference in the cost of operating, there will be a saving of the entire expense of operation of the horse roller for three reasons. If this statement is true, the use of a horse roller is anything but economical.

Another great advantage that steam rollers have over horse rollers is that they can be used for tearing up the surface of streets and repairing without the use of new material. They can also be used as traction engines for hauling the material, and can be used as stationary engines for furnishing power to drive stone crushers and other machinery.

THE CURSE OF NARROW TIRES.

Through State aid there have been built in the State of New Jersey about four hundred and fifty miles of hard roads. Counties, boroughs, townships and other municipalities have constructed as many more. The general prevalence of these roads leading to and from the great centers, has tempted the owners of wagons to increase their loads from one to two tons to four and five tons, and in most cases are moving these loads on narrow tires. Besides, the drivers have an insane desire to travel in one path; in this path their wedge-shaped tires force their way into the heart of our best constructed roads, inevitably making ruts that are the catchments of rain fall. This softens the bed and destroys the resistance to pressure, thus working great destruction to the expensive works the State and counties have so largely created for the benefit of the public.

Individuals having a full knowledge of this and also of the

greater economy of broad tires for all kinds of traffic over every condition of road, will persist in this practice of wholesale destruction of these improved highways, regardless of the expense they entail upon themselves and communities as tax payers; therefore, is it not the part of wisdom for the Legislative and Executive powers of the State to pass compulsory laws to protect that which they have so wisely and generously built for the public benefit? The improved roads of the State represent an outlay of at least four millions of dollars, and why they should not be guarded from the needless and careless destruction of thoughtless owners and drivers of freight vehicles is beyond our comprehension.

We seriously hope our coming Legislators will enact some radical measures in this direction and thus save the counties in the future immense outlays for repairs.

RAVELLING AND RUTTING OF ROADS.

Ravelling and rutting are the two evils with which we have most to contend in maintaining the surface of our roads in proper condition. Our seasons are so variable, being sometimes intensely dry, when ravelling results, at other times intensely wet, when rutting is more apt to take place. The rutting is largely the result of using a soft binder between the stones, and my observation is that it is a vicious practice that should be dispensed with. Rutting will in a great measure be overcome when broad instead of narrow tires become the rule.

To obviate the ravelling various plans have been resorted to with a certain measure of success. Where wetting can be daily practiced roads maintain their integrity without much trouble. Where wetting is too expensive, the smoothness of the surface has been retained by the application of loamy gravel in dry weather and sand in wet and wintry seasons; each one of these materials has in several counties contributed largely to maintain a smooth surface, and as their utility is made manifest they will be more generally used. These materials take the water from the surface of the road and can generally be very cheaply applied as they in most



Cranbury Station Road,
Middlesex county. Before.



Cranbury Station Road,
Middlesex county, 8-inch macadam over fertile loam soil. After.



cases lie alongside or contiguous to the roadbeds. Their application has become almost general in our southern counties.

REPAIRS TO STONE ROADS.

Fine roads are the result of a repair system, where every defect is promptly corrected before it has time to cause serious damage. American pavements are generally well constructed. Some of them, however, soon become rutted and ravelled. These conditions arise from neglect of our authorities to promptly and properly repair the wear and tear from many sources. All roads should have perpetual attention. If a hollow or rut is formed it should at once be filled slightly with broken stone, wet and rolled. In our country the picking of the toes of the horses' iron shoes loosen the stones, and the wedge-like action of the narrow tires repeatedly passing in one track produces ruts that gather water which softens the roadbed. Then, too, the extreme dryness of our climate destroys the cohesive power of the stone dust, allowing it to be easily blown from the roadbed by the frequent wind storms.

The ordinary remedy for the last evil would be frequent watering. A slight amount of moisture frequently administered quickly destroys the tendency to ravel by increasing the binding power of the stone dust.

The remedy for the rutting would be the substitution of wide for narrow tires, the extension of the doubletrees of heavy wagons so as to bring the centre of the singletrees on a line with the wagon wheels; then the wheels and horses moving in the same path, the horses would correct the ruts, and the wheels, especially if clothed with wide tires, would press down the stones loosened by the animals' feet. This latter device, I am glad to say, is being gradually adopted in many sections, but as our people contend that it would be too expensive to water our roads when dry, or to quickly change their wheels from narrow to broad tires, it has become necessary for the guardians of our roads to devise some other means by which they can easily and cheaply maintain a smooth surface. In the southern portion of our State frequent

applications of light coats of coarse sand, gravel and loam have proved to be the most practical means of preventing ravelling. Sand covers the protruding edges of the stone, makes a smother surface, a cushion for the horses' feet, and relieves the contact of the wheels with the stones. Where this coating has been renewed as soon as the winds and rain have blown or washed it away, all complaints of ravelling have ceased.

The application of these materials to the thousand miles of macadam roads in the State would save an immense amount, not only in the ravelling, but in the wear of stones. We have in mind several roads whose surfaces have been thus treated.

On Long Island it has for a long while been the practice to keep the roads covered with from one-eighth to one-fourth inches of sand, with the result that their roads generally present a very smooth and pleasant surface to the traveller.

On one of our best constructed roads, leading from Mount Holly to Pemberton, after the contractor had finished it, he employed a man to keep the surface in order for one year, and furnished him all the necessary fine stone and screenings. Although he liberally applied these materials, the heavy winds blew them away; so we persuaded him to cover a mile of the road with sand. The press and public violently condemned the action, saying: "We are paying for stone and receiving sand." But after two weeks of trial we were besieged from all quarters to have the whole five miles covered with this material, and this practice has been maintained for three years, to the satisfaction of all concerned, and the road is one of the best preserved in the State. Attention was first drawn to this value of sand by noticing the fine condition of sections where it had drifted over the stone bed. If we were certain that the days would always be dry a small amount of clay loam would answer the same purpose, and perhaps make a smoother road than the sand; but if there is too much clay in the loam, when the rain comes the tractive power of the clay would lift the stones by adhering both to the stones and tires of the wheels.

Where rutting has become a feature of the road and ruts are deep, they should be filled during the moist season of the year

with trap rock stones of $1\frac{1}{4}$ inch size, covered with screenings and sand, and repeatedly rolled with a heavy roller; when the ruts are light a heavy roller in moist weather will smooth the surface. An occasional scraping of the stone dust from the sides to the centre, and then the application of a steam or heavy horse roller often cheaply remedies many of the defections of which our people complain.

In many portions of the State our freeholders display more zeal in the building of new roads than they do in keeping in repair those already constructed, believing a stone road is permanent and capable of caring for itself because it is stone; but they are gradually being awakened by the complaints of those who use them, and hence are giving the repairs more attention. The State law provides for a supervisor in each county, who shall be constantly watching and correcting all tendencies toward disintegration; also allows any private citizen to mandamus the freeholders when they fail to keep them in order; thus all the machinery is provided to cause all our roads to be models of excellence.

FOUNDATION.

The stability, permanence and maintenance of any pavement depend upon its foundation. If the foundation be weak the surface, even if it be the very best material, will quickly settle into a series of holes and ruts. The foundation should be thoroughly and uniformly compacted by rolling with a heavy steam roller until it forms an unyielding surface having the same outline the surface is to have. Further, a good foundation can only be made permanent by keeping it dry. If the covering be thick and well bonded, but not water tight, it will still protect the foundation from the destructive effects of the traffic, but cannot protect it from the attacks of water, which soften it and make it anything but firm and unyielding. Practically water tight roads can be made of broken stone or gravel, although it has been proved that hard broken stone will not combine by its own angles into a smooth, solid surface, and when rolled with heavy steam rollers as solid as possible the open spaces comprise one-fourth of the bulk of the

whole mass. It is plain then that this broken stone road would not be water tight unless we fill up the spaces with something; so recourse can be had to the use of binding material, which must be rolled into the spaces after the stone is compactd. To do this it is best to use sharp sand, three-quarter inch stone and screenings, and thoroughly drench with water; pass the roller rapidly back and forth over the sand and water, making a regular thick cement which runs into all spaces. This operation must be continued until the road will absorb no more. This cement must be thin enough to run in front of the wheels of the roller like a wave; a large amount of water will be required during the operation.

A gravel or broken stone road can by this means be made practically water tight.

THOROUGH DRAINAGE A NECESSITY.

There is no enemy of good roads so ubiquitous, so insidious, so persistent and so fatal in its doings as water. Moisture penetrating a road surface or working in under a road bed from the sides, or in any way percolating to its foundation will do more to injure roads than any other known agent of destruction. Rain, like death and taxes, is sure to come and is certain to do harm unless carried away by a system of thorough drainage. If such a system is not provided, a smooth, compact and well wearing road surface cannot be maintained. Mud and ruts will appear in summer and the frost break up and ruin the road in the spring whether it is a macadam or dirt road. As a rule roads are inadequately and improperly drained because of the importance of thorough drainage is not at all understood. Many roads are only too frequently just the reverse of highways—they are the gutters of the country. Lots of country roads exist with the sides sloping up from them so that they serve as a trough for all the water that falls. A still greater number of roads run on a level with the road sides and are but little better, for water will stand and soak in wherever adequate provision is not made to carry it away. Roads should always be so laid out that no water can find its way upon them from the adjoining lands which may be higher and which tend to shed the rainfalls toward the roadways. To prevent this



Fanover and Afton Road,
Morris county, 6-inch macadam. After improvement.



Hanover and Afton Road,
Morris county, 6-inch macadam. After improvement.

the ditches on either side of the road must be of ample capacity to carry off any rain that may fall. It not infrequently happens that one side of the road is higher than the other and that at some point the water from the higher side flows across the roadway and maintains a perpetual mudhole where it crosses. The function of a road surface is that of a roof whose purpose is to keep the base dry by shedding all the water that falls upon it; it cannot do this if it is not so graded and shaped as to permit—water to readily run off, so kept in repair as to always have a smooth and even surface and so thoroughly drained as to carry away all water without overflow. The side ditches should have a fall throughout the length, and their size should depend upon the maximum volume of water they are likely to be called upon to carry. They should always be kept clean and free from obstructions, and if the water cuts their bottom the channel should be protected by paving. It sometimes happens that it is impossible to make open ditches deep enough to drain the centre of the roadbed, and when this is the case it is necessary to use side or central drains. In a macadam road the foundation course should be somewhat porous so that if any rain works down from the road surface or finds its way in from the sides it may be able to reach the drains and be led off by them. A drain of four-inch earthen pipe placed beneath each gutter at a depth of $3\frac{1}{2}$ feet below the crown of the road and covered with broken stone, coarse gravel or pebbles nearly up to the surface should be used, and will generally prove sufficient; but if a road lies in a very wet place it will be better and more effective to locate a larger drain under the centre of the road. In all cases a slight fall must be provided for and a free, open outlet must be maintained.

Without attention to these principles a good road cannot be maintained, but if in addition to them a road is well built and a thorough system of maintenance is carried out, good highways can be had for less outlay and expense than the wretched ones which now so generally prevail.—*The Hub*.

MACADAM ROAD CONSTRUCTION.

In the public mind, a road is any passageway over or through which a vehicle may be hauled, however laboriously, and a good road is one which remains firm and smooth in dry weather and is fairly passable in winter and spring. Until recently it may be fairly said that there has been no general conception of a first class, permanent road, which would be good at all seasons and under all conditions. For twelve years, however, the advocates of highway improvement and good roads have been trying to show that such roads are necessary and possible, and that macadam roads come nearest to meeting all requirements.

It has thus come about that road improvement, at the present time, outside of the large cities, may be said to deal almost entirely with the laying of macadam roads, and the term macadam has become synonymous with good roads. But, even now, the popular definition of a macadam road would be something like this: A layer, or layers, of broken stone of varying thickness, laid on a more or less prepared roadbed, and rolled down, more or less, by some roller. The other elements which enter into the construction of a good road are not only unrecognized, but almost entirely unknown—grading, drainage, size of stone, thickness of layers, amount of rolling, finish of surface and subsequent maintenance are not considered or even thought of, and even among supposed experts few of these items receive the consideration they need, and because of this very few macadam roads give the results expected of them, or what they would give if they were properly constructed and maintained. It is not the principle, but the method of acting on it which is at fault.

The term "macadam" is now applied promiscuously to the process of laying broken stone upon a roadbed, no matter what the preparation for it, the size and character of the stone, or the method employed; it is thus, unfortunately, coming to mean less and less as a description of road construction and to be less synonymous than formerly with the term "good roads."

Of course, stone roads were made before MacAdam's time, but not as he came to build them. MacAdam found a scientific

basis for road construction, and he demonstrated the correctness of his theories so conclusively that roads of broken stone are to-day called almost universally by his name. His contentions were these, and he put his theories into practice constantly and successfully. He said that nothing can make as good a road as dry earth, and that, no matter what may be placed over it, the ground is really the road and must bear the weight of the broken stone and of passing vehicles as well. The great object of road making, therefore, is to keep the earth dry; the only use of stones being to form a roof for that purpose; consequently, the thickness of the coating should be regulated by the quantity of the material necessary to form an impervious covering, and not by reference to its own power of carrying weight. To secure this result he insisted on having the stone broken quite small, six ounces in weight being the largest size used. The road was to be carefully graded, with a slight convexity of surface, to secure perfect drainage, and the stone was then spread on evenly to a depth of from five to ten inches, without any admixture of earth, clay or gravel under any circumstances. MacAdam asserted that clean, broken stone will always combine by its own angles into a smooth and solid surface which will not be affected by the vicissitudes of weather, and he contended that stones so laid would, under the influence of travel, become so perfectly compacted as to be impervious to water. He also claimed that an elastic foundation reduced wear on the surface, and he considered a foundation of large stone or rock as an actual detriment, as tending to admit water and increase wear. In some cases he made roads but three or four inches deep, but generally they were from five to ten inches.

MacAdam was followed by Telford, who used large broken stones for his foundation course and layers of smaller stones above, and, finally, a coating of gravel on the surface. Both systems were introduced into this country, at first the latter being used in a somewhat modified form; but, by degrees, it has been pretty generally discarded, and MacAdam's system is now almost universal, much improved in some respects by modern appliances and injured at times by mistaken departures from some of his fundamental principles.

When the first macadam or telford roads were laid in this country they were constructed with painstaking care and at great expense. For many years an outlay of at least \$10,000 per mile was considered necessary, and these figures prevailed in Massachusetts until very recently. But, with increased experience, improved facilities and greater demand the expense was gradually reduced. Then came the popular movement for good and cheap roads, and every possible device was resorted to in order to lower the cost, perhaps the most prominent being the curtailment in width and restriction of depth. On this latter point there has been considerable controversy, some contending that six to ten inches of stone were necessary, and others claiming that four or five inches were sufficient.

The advocates of good roads who sought the construction of scientific, well built and permanent highways have been forced to be satisfied with almost any sort of stone roads, in order to see the mileage of hard roads increased. Cheap construction and many miles for small outlay have been demanded, and, consequently, long stretches of excessively thin "macadam" have been laid on improperly prepared and inadequately drained surfaces, and when laid, have been neglected. Results have necessarily been unsatisfactory.

Road building is a science which is, as yet, but very imperfectly understood in this country, and, when understood, is very seldom faithfully followed out, even engineers who pose as authorities often neglecting important requirements and frequently utterly failing to provide for any system of maintenance after a road has been completed. They seem to imagine, in common with the great majority, that a road once laid requires no further attention.

If a new road were under consideration the first point would be its location, course or route, which should be as free from steep grades as possible, it being remembered that it is easier to haul three miles on the level than one mile over a fairly steep hill. But most roads which are to be macadamized already exist, and generally pursue tolerably direct courses up and down hill, regardless of results. All traffic over any road must load for the worst spot on the road, and carry only such weight as can be drawn over the

highest hill or softest spot. It is therefore both prudent and economical, in the long run, to frequently alter the course of country roads and re-locate them, in order to secure easy hauls and make it possible to reduce wear and tear. This can generally be done successfully, but when impossible, grades should be reduced. It is better to go once to expenses of this kind than to lay a stone road over a bad road and steep hills and entail unnecessary delay and expense on all future generations.

The route once selected, the questions of drainage and grading require most careful consideration, and much more thorough attention than they are wont to receive. The worst foe of a road is water, whether standing on it, soaking through it or finding its way from the sides under the foundation. Wherever it may be in proximity to a roadbed it has disastrous results. In order to secure a firm and permanent roadway, it is absolutely necessary to provide thorough sub drainage, which will carry off quickly any water which tends to collect under the stones or soak through them; it is also equally necessary to provide surface drainage and to keep the roadbed free from ruts and depressions, so that water will not remain on it. Standing pools of water quickly soften the road, so that the wheels of passing vehicles cut it up and disintegrate it. Unless both surface and sub drainage are amply provided, no road can long remain good. The grading, which accompanies the drainage prepares a suitable, slightly rounded surface, higher than the road sides, or with ample ditches between, and makes ready for the stone.

In laying the stone, the principle to be observed is to put it down in layers and thoroughly roll each, with suitably heavy rollers, without the use of "binding material," and, when completed, to institute a system of competent maintenance. But these two subjects are too comprehensive for consideration in this connection, but must be treated separately at a future time.—*The Hub*.

ROAD STONES.

The practice of using too soft, too brittle, or rotten material on roads cannot be too severely condemned. Some people seem to think that if a stone quarries easily, breaks easily, and packs readily, it is the very best stone for road building. This practice, together with that of placing the material on unimproved foundations and leaving it thus for traffic to consolidate, has done a great deal to destroy the confidence of many people in stone roads. There is no reason in the world why a road should not last for ages if it is built of good material and kept in proper repair. If this is not done the money spent is more than wasted. It is more economical, as a rule, to bring good materials a long distance by rail or water than to employ inferior ones procured close at hand.

The durability of roads depends largely upon the power of the materials of which they are composed to resist those natural and artificial forces which are constantly acting to destroy them. The fragments of which they are constructed are liable to be attacked in cold climates by frost, and in all climates by water and wind. If composed of stone or gravel the particles are constantly grinding against each other and being exposed to the impact of tires of vehicles and the feet of animals. Atmospheric agencies are also at work decomposing and disintegrating the material. It is obviously necessary, therefore, that great care be exercised in selecting for the surfacing of roads those stones which are less liable to be destroyed or decomposed by these physical, dynamical and chemical forces.

USEFUL STONES FOR ROAD BUILDING.

Siliceous materials, those composed of flint or quartz, although hard, are brittle and deficient in toughness. Granite is not desirable because it is composed of three materials of different natures, viz. : quartz, feldspar and mica, the first of which is brittle, the second liable to decompose rapidly, and the third laminable or of a scaly or layerlike nature. Some granites which contain hornblende instead of feldspar are desirable. The darker the



Junction of Pompton Pike and Grove Street,
Essex county, 8-inch telford, by State Aid, showing deep cuts in both roads.



Trenton and Asylum Road,
Mercer county, 6-inch macadam.



variety the better. Gneiss, which is composed of quartz, feldspar and mica, more or less distinctly slaty, is inferior to granite. Mica-slate stones are altogether useless. The argillaceous slates, or clayey slates, make a smooth surface, but one which is easily destroyed when wet. The sandstones are utterly useless for road building. The tougher limestones are very good, but the softer ones, though they bind and make a smooth surface very quickly, are too weak for heavy loads; they wear, wash and blow away very rapidly.

The materials employed for surfacing roads should be both hard and tough, and should possess by all means cementing and recementing qualities. For the Southern States, where there are no frosts to contend with, the best qualities of limestone are considered quite satisfactory so far as the cementing and recementing qualities are concerned, but in most cases roads built of this class of material do not stand the wear and tear of traffic like those built of trap rock, and when exposed to the severe Northern winters such material disintegrates very rapidly. In fact, trap rock, "nigger heads," technically known as diabase and diorites, are considered by most road engineers of long experience to be the very best stones for road building. Trap rocks as a rule possess all the qualities most desired for road stones. They are hard and tough, and when properly broken to small sizes and rolled thoroughly, cement and consolidate into a smooth, hard crust which is impervious to water, and the broken particles are so heavy that they are not readily blown or washed away.

Unfortunately the most useful stones for road building are the most difficult to prepare, and as trap rocks are harder to break than any other stones they usually cost more. The foundation or lower courses may be formed of some of the softer stones, like gneiss or limestone, but trap rock should be used for the wearing surface, if possible, even if it has to be brought from a distance.

HON. M. O. ELDRIDGE, in "*Farmers' Bulletin No. 95.*"

BRICK PAVING VERSUS MACADAM.

Our observation on the comparative qualities of macadam and brick in the several towns where both plans of building are followed is in favor of the brick pavement, and as we have so many petitions for macadam roads through towns of considerable size we always advise the construction of brick pavements on the business streets in the place of macadam. To meet the conditions of the city or town pavement the pavement should be cheap, easily maintained, cleanly, as noiseless as possible, smooth and lasting. In a small place it must be cheap. Macadam and telford pavements are cheap in first cost. They can be laid in this country from thirty to seventy-five cents per square yard. But macadam requires to be kept in the very best condition in order to give the service required of it in a town. They are only kept in high condition by the constant service of the repair men, the water cart and the steam roller. This can be done in large cities, but in small towns vigilance comes by spurts. Cobble stones and granite blocks are noisy and dirty and offer considerable resistance to traction owing to the rough surface which they possess. Asphalt pavement in some localities is ideal, but it is difficult to lay one that will stand the extreme climatic variations. It is apt to decay from the ammonia of the droppings and requires constant attention to keep it in a healthy condition. Paving brick seems to answer a more useful purpose than any other material that is offered, and has long been in use. In Holland it has been in use for more than a century and has always given excellent satisfaction where properly prepared. Its foundation can be constructed of cinders four inches thick, rolled thoroughly; over the cinders spread a thin cushion of sand, then cover this with a layer of brick laid flat, the longer diameter parallel to the street. These to be rolled and covered with a two-inch cushion of sand; then the top and wearing course of brick should be set at right angles to the street. When in place and rolled, sand, pitch, asphaltum, cement or patent mixture known as grout should be poured into the joints to act as a filler. When materials for concrete can be

obtained cheaply the streets should be at first graded, rolled and then covered with six inches of concrete and over this a top course of brick laid as in other pavements. The brick used should be a semi-vitrified or incipiently vitrified brick. They make the best pavers. The clay used in making paving brick is mainly in pure fire clays and shales, the cheap class of shales for which there has heretofore been little market. The shales occur abundantly in connection with coal beds, which makes their production cheap on account of the fuel being so handy. The process includes grinding the clay, mixing it with water, moulding it, drying the green brick and lastly burning them. Burning is the most important and most expensive part of the process. It should be fired gently at first, then gradually raised to about 2,000 degrees Fahrenheit and allowed to cool slowly. Under-burned brick should not be used and the over-burned is too glassy and chips easily. In the West these bricks sell for about ten dollars a thousand. The cost of the pavement runs from one dollar to one dollar and a half per square yard. The cost is influenced by a wide variety of factors, cost of transportation probably being the greatest. Aside from its average low cost brick pavement has many incidental advantages in small towns. It does not require a high order of skill either to lay or repair. Its quality may be determined before it is laid. It is clean, fairly noiseless, and, under ordinary conditions, it is long-lived. Its lasting qualities have not been fully determined. At Bloomington, Ill., it gave excellent service for twenty years. The brick now marketed is very superior to that in use a few years ago. In many cities no brick pavement of first quality has yet been worn out. Well made pavements are as strong as granite and are fully equal to the demands of any ordinary traffic. Immense quantities of them are being used in the West, where they range from seven to ten dollars per thousand. Well paved brick streets rank high among the different classes of municipal improvements.

A STANDARD PAVEMENT.

A standard pavement for streets, other than those in the immediate business section, should be macadam. A well-kept macadam driveway is in keeping with well-kept boulevards, lawns and shade trees, the characteristics of a residential street; it has a cool appearance, the dust can be readily kept down by sprinkling, and for light driving is the favorite among horse-men. Bicyclists, now an important section of the community, usually favor macadam, in preference to the more costly classes of pavement. A comparison of macadam with asphalt or vitrified brick, in point of utility and beauty, will not result unfavorably to the former, for use on residential streets. It is not to be inferred, however, that broken stone roadways are recommended for streets in the immediate business section, where a harder and, in a sense, a cleaner surface is desirable.

By proper attention to repairs, the life of this class of pavement can be made continuous. The surface can be frequently rolled, improving it greatly. It can be scraped and swept as are other pavements. When it begins to lose shape the surface can be loosened up by means of teeth attached to the roller, a light coating of new material applied, and then rolled down as well as when new. It is by such means as these that broken stone roadways can be made much more economical and satisfactory than any other for streets generally. This ease of renewal and repair is a property peculiar to macdam, which renders it most satisfactory for general purposes. It forms a permanent basis, and its perpetuation is merely a matter of repair to be met by the general funds.

Except under excessive wear, or where in business sections a high-grade pavement is necessary, broken stone pavements, by the aid of a steam road roller, are beyond doubt the most serviceable and economical, and give greatest satisfaction to the taxpayer.



Franklinville Road,
Gloucester county. Laying Gravel bed over sand.



Franklinville Road,
Gloucester county. After gravelling.

GRAVEL ROADS.

As the State by the State Aid Law is more or less committed to the construction of gravel highways, and as it has already been instrumental in creating about seventy miles of these, it becomes important that we should thoroughly study the character of all their necessary elements, in order that this form of improvement may be made as permanent as possible. When the State and counties commenced building these we were confronted in many cases with an entire absence of gravel beds, in others with gravel pockets that although in the same bank were not uniform in their layers. There was perfect material in some pockets, sand in others, and in others loose stones with no admixture of clay or other binder. In some localities we encountered heavy clay beds, and further along beds that were composed of loose stones with no binding material to cohere them; so we were forced to resort to various expedients in order to have a reasonably hard and permanent roadway. In many sections we practiced extraordinary care that sand be not deposited in one place, loose gravel and stones in another, and clay in another. In loading the wagons the shovellers had to be carefully watched to cause them to throw fixed quantities of each class of material upon the wagon, so that when they came to be deposited on the roadbed they would mix in proper proportions. In other cases we overcame these imperfect conditions by depositing a layer of stiff clay over the roadbed, then spreading pure gravel stones over it, and then thoroughly plowing and mixing the two materials together. We thus succeeded in creating an artificial gravel which is found to wear as well as those formations in which nature has done the mixing. In other places we found beds in which a certain kind of clay so thoroughly predominated that during the dry seasons it made a road as hard as stone; but when the wet and wintry season came the water so penetrated it there was but little upbearing strength to it. We remedied this bad condition by covering and mixing with it a loose, sandy gravel, and thus formed a reasonably perfect roadway sufficient for most seasons of the year. We have found that where we placed a fairly

good ferruginous gravel upon a pure sand bed (as are most roadbeds through our pine districts) we have succeeded in maintaining a surface that will stand up many years; but if the same gravel were placed upon a clay foundation, there would be no bottom to the roadway in wet and freezing seasons; therefore, in the application of gravel the soil must be carefully studied or we will produce worse conditions than we had before we commenced. In the formation of perfect gravel roadbeds it seems necessary to exercise more caution, more care, and as much knowledge as in the construction of hard roads of stone, or they will be soft in some places, hard in others, and, after a few months of wear, will present a very uneven surface that will endure a very small amount of heavy traffic. Our experience has also demonstrated that where roads are constructed through districts moderately fertile, where the traffic is not very heavy, it is in the long run more economical to construct of stone, for if the gravel is not found near the highway, and has to be carried or carted long distances, the cost approximates so nearly that of stone there is but little economy in its use. Another objection is that our county officials are apt to wait too long before giving them needed attention. The stone roads can stand neglect for weeks or months, and not, in many cases, be very materially damaged or the traffic much interfered with; but the gravel road needs frequent scraping and filling when the traffic is heavy or the weather renders it soft. All public works should be of more substantial character than those owned by individuals or corporations, for pecuniary considerations influence them to greater attention than when controlled by public officials. Therefore, we do not think it the part of wisdom for the State to enter into the construction of gravel roads except in poorly settled communities and in farming or pine districts, where gravel is abundant and where the source of supply is near the roadbed.

The State and counties have created some very pretty roadways of gravel which are at present the pride of the districts through which they run. They form fine, easy paths for the passage of moderately weighted vehicles, and are about the only roads that many of these localities can afford to build; but in

thickly settled farming districts the temptation to build is so great, on account of their comparative cheapness, that it is not amiss to caution against entering too heartily into their construction, especially as our experience has been that it is often very difficult in these neighborhoods to discover gravel of sufficient binding and wearing qualities to make a durable roadbed. The petitioners are often deceived as to the amount of material nature has deposited in their localities, so they have several times been forced to change their specifications and re-advertise for stone, thus losing the State appropriation for that year. It is our impression that on many of the highways that are being constructed of gravel, the freeholders, in order to maintain their integrity, will in time find it more economical or absolutely necessary to spread a few inches of broken stone, for the law compels them to maintain a hard surface to State Aid roadbeds, and it will be absolutely impossible to do so with the gravel that is located along many of them. Some of the old gravel roads that are almost perfect in summer are at the worst in winter, being at times almost impassable. For several of these we have been persuaded by the residents along them to approve of specifications to re-grade and cover them with stone; thus experience demonstrates that truly permanent highways can only be made of stone. If we could make our gravel highways by sifting all the material through meshes of different sizes, in order that gravel containing too much earth or clay could be rid of the superfluity, and then all the necessary elements mixed in proper proportions, we might make a roadbed which, although more expensive, would wear for a long time.

Roads constructed over clay soils should have at least six inches of coarse gravel mixed with the clay, so that under the weight of traffic the stones would be consolidated so completely with the clay they would prevent the surface water from percolating through and softening it. Before placing the gravel upon any road great care should be exercised to bring the roadbed to a proper grade, eradicating all ruts, mud holes or depressions. A good, even, regular, solid foundation should be even more completely obtained than where stone is used, and to properly place the gravel it should be put in layers and each layer thoroughly

rolled and mixed; where it is too dry to properly consolidate, water should be used. I have seen a few gravel roads that are almost as hard as stone, but they are principally those where natural conditions have unwittingly entered to produce the proper combinations; but the majority of these roads present no such conditions. Therefore, extreme care must be continually exercised in their construction in order that art can assist in forming perfect roadbeds.

THICKNESS OF ROADS.

As we have many contentions with localities claiming State Aid about the proper thickness to build stone roads, we will write of our experience and observation, which confirms us in the belief that good, strong, well-wearing, perfectly upholding roads do not depend upon thickness. When the bottom is good a thin road can be made to perform as effective service as a thick one. A road is more valuable to a community for its length and width than for its thickness. To my testimony I will add that of some of the most celebrated road engineers of this country.

Mr. Lewis, M. Am. Soc. C. E., says that a road six or eight inches in depth will certainly sustain any traffic that may be placed upon it.

Mr. Calvin Tompkins, M. A. Soc. C. E., says, "make a thin road go as far as possible; a thin road can be made to do as well as a thick one, and money will be saved."

Mr. C. A. Roullier, M. A. Soc. C. E., says that expansion of good roads depends upon how thin they can be safely built. The upholding of the surface depends upon how they are put together, and is absolutely independent of the thickness; further increase than is absolutely necessary to bear the traffic is a waste of material.

Mr. J. J. McLaughlin, M. A. Soc. C. E., says that the sustaining power of a thin road properly constructed is as great as a thick one.

Mr. Warren B. Travell, Jr., M. Am. Soc. C. E., has built roads only two inches in depth that have not shown signs of giving out.

Mr. William L. Whitmore, County Engineer of Passaic, has built one hundred and fifty miles of four inch roads that have given excellent satisfaction, and are nearly all in fine condition after years of wear.

Mr. William E. King, County Engineer of Morris, says that Morris county has built about one hundred miles of four and six inch roads which have for years sustained the traffic and are in good condition.

Hon. D. D. Denise, Mayor of Freehold, says that on account of the almost impassable condition in winter time of their main street they were forced to spread over the surface four inches of loose stone, allowing the traffic to bring it down to final repose. It has, under all conditions of weather, supported the traffic so satisfactorily that their Council has decided to cover all their leading streets with the same thickness of stone, applying two thousand tons each year.

The townships of Bergen and Passaic counties have built many miles of four inch roads. Their sustaining and wearing power is so great that they are constantly adding roads of the same thickness to their mileage. Many towns and townships in other counties are improving their streets with light coverings of stone, which, with reasonable repairs, sustain the traffic for years.

Long Island, Connecticut and other States have built many miles of light roads and thereby been able to give larger areas greater benefit than if the same money had been expended in unnecessarily thick pavements with thousands of tons of stones only serving as a foundation, where earth well prepared and drained answers the same purpose.

WHAT ARE BAD ROADS COSTING THE FARMERS.

The cost of good roads can be stated in dollars and cents, but it is not so with bad roads. Bad roads are costing some citizens of New Jersey half their life time in driving over them. To drive one mile occupies the time it would take to drive five if the roads were good. They are costing many a farmer much of the self respect he feels when driving along a good road at a good pace

with clean buggy, clean harness and a clean horse. They are costing our farmers small sums which soon aggregate large sums in repairs to wagons, harness and whips. They are costing the privilege of attending church and public meetings at many seasons of the year. They are costing the young people a considerable part of their education, costing them the privileges of society, which every healthy mind demands. They are costing the rural districts a large share of their population, which, in disgust at the stagnancy of farm life, drifts to the cities overflowing the professions and trades, and lessening the value of farm property, to which can be added the loss to trade and commerce, to the railway and transportation system and the manufacturing and dairy interests, all of which are direct and indirect losers. Good roads bring prosperity and prosperity brings good roads. They go hand in hand, each assisting the other. A recent writer has said that Spain would not have lost Cuba if she had joined the good roads movement. Her roads are in a most wretched condition. We have not yet learned what Rome knew one thousand years ago, that roads are the arteries of commerce along which flows the life stream of a nation, bearing success, civilization and contentment to the inhabitants. Under our State Aid Law the farmer and rural population do not pay the entire cost of road building. Good country roads are expensive and in every way necessary for the development of the country, and when the farmer bore the entire burden it was difficult to secure good roads. The towns are not complaining at their share of the cost. It gives them free and uninterrupted communication with the surrounding country at all seasons of the year, and they seem to be willing to pay a fair proportion of the cost. The principle of State Aid has been recognized by Massachusetts, Connecticut, New Jersey, Rhode Island, Vermont and New York. In this the entire population, urban as well as rural, contributes to the cost of country road building. In all European countries national aid in one form or another is given. In England the County Council has entire jurisdiction over the roads and is aided by a grant from the National Treasury. The roads of Scotland and Ireland are also under a system of county management.

French roads are national, departmental and communal, corresponding largely to State, county and township roads. The national roads radiate from Paris, extending to all the important cities and departments. The second and third classes, departmental and provisional roads are in a general way under local authorities, but departmental roads are usually intrusted to the care of a national corps of engineers. Germany has a magnificent system of turnpikes, built and maintained by the National Governments under the general management of a State Road Commissioner, assisted by an intelligent staff of directors and inspectors. Other roads known as country roads are built and maintained by the several parishes through which they pass. The highways of Austria are classified as State or Imperial roads, provincial roads, district roads and community roads, according to the authority in constructing and managing them. The cost of the Imperial roads is derived from the national funds, the cost of the provincial roads from the provincial funds, the cost of the district roads from the district funds and the cost of the community roads from the community funds. Road keepers are constantly at work on repairs.

Italian roads are national, provincial, communal or vicinal, according to the source from which the taxes for construction and maintenance are derived. They are under the supervision of the Minister of Public Works. The important roads of Denmark are controlled by the County Councils, but are subject to the annual inspection of the State Engineer. Roads of less importance are governed by the Parish or Township Councils. The main roads of Belgium, the through routes, are controlled and managed by the State, provincial roads by the province and community roads by the community authorities. The construction of these roads is intrusted to a corps of engineers. In the Netherlands a network of roads providing for convenient travel from one part of the country to another is maintained by the General Governments. Other roads are at the expense of the various provinces and communities benefited. The Federal Government of Switzerland controls a few of the important roads, but in the main they are built and maintained by the Cantonian Govern-

ments through which they pass. Spain, Turkey and Russia have not joined the good roads movement. In these countries of good roads it is an unusual occurrence to see a load drawn by more than one horse. So excellent are the roads in these countries that any one owning a team of horses does not consider himself dependent upon the railways for transportation, as wagon loads of from three to six tons are frequently drawn several hundred miles in competition with railroad rates. In these cases the roads are of course of the best possible construction, built and maintained under engineering supervision, and are a skillful compromise between ease of grade and directness of route.

A STATE AND COUNTY SYSTEM.

Under our State Aid Law the management of our leading roads is rapidly becoming a county charge, and this in the interest of good roads is a consummation very much to be desired. Under this system a thoroughly organized corps of men can be employed, who, from being experienced, can perform better work and are ready to repair as soon as signs of wear appear. By a county plan uniformity in system and work will be secured throughout the various municipalities, whereas under township control a diversity of plans is sure to be adopted.

Under the State Aid Law an experienced and properly qualified supervisor must be employed to have constant supervision of the work, whereas under township control each municipality cannot afford to pay the salary of such a man. Under every good system of government it is necessary to have responsibility centralized and defined and not divided and easily shifted from one to another.

Under county control machinery can be handled to better advantage, as an experienced operator can be employed for each implement, and a better and more uniform class of work will be secured.


A properly connected system of leading roads throughout our State and counties is being obtained, whereas if each township had worked independently of those around it this result would not

have been consummated. There is little community of interests between the townships. In one township there may be a certain leading road much travelled, well made and maintained. The adjoining municipality may, for various reasons, not consider the continuance of that road through it of so much importance as to warrant them in making an expenditure to benefit their neighbors who are obliged to travel over it.

By a county system the county tax will be reduced, because most of the township expenditure now placed on leading roads will be relieved or saved for the less important roads. Under the county system the funds are sufficiently concentrated for continuous and durable work, and, consequently, these roads will be properly constructed and afterwards maintained at the expense of the county. The State and county road law equalizes the cost of maintaining leading roads. In every county within a certain radius of a market town traffic constantly increases as the town is approached. The cost of construction and maintenance increases in proportion to the traffic. It is then unfair to charge those living near the town with the cost of keeping the roads to support the traffic from a distance.

Property is very largely valued according to distance from the market, and the convenience with which the market can be reached. Property a long distance from the market is affected to a greater extent by the bad condition of the roads than is property very near the market. Good roads are, therefore, of greater value to persons living a long distance from the market town than to those in the immediate vicinity.

Under our State and county system proper road construction is being performed, and the economic value of the work is seen and appreciated by the people of the different sections. Our well built roads stand as object lessons for teaching better expenditure of the township funds on the roads maintained by them.



TARRED MACADAM.

The American Contractor reports the paving of streets in Hamilton, Canada, with tarred macadam that costs only 76 cents per square yard, and is a very satisfactory pavement. Inquiry of the Hamilton street committee gained the following statements in response: First, that the price reported was correct, the paving costing only 76 cents per square yard. Second, that they have streets which have been paved for ten and fifteen years, and they have been kept in good repair at small expense. Third, that "tarred macadam" is the most satisfactory pavement they have in that city.

The construction is described as follows: After the street has been excavated and graded and rolled, four inches of crushed stone is spread on and thoroughly rolled. Then a coating is put on of crushed stone and tar, both stone and tar being heated and mixed while hot and rolled down into a solid mass. There is some pitch added to the tar. The road is surfaced with three-fourths of an inch of mixed tar and gravel rolled down smoothly.

ARTIFICIAL PAVING STONES.

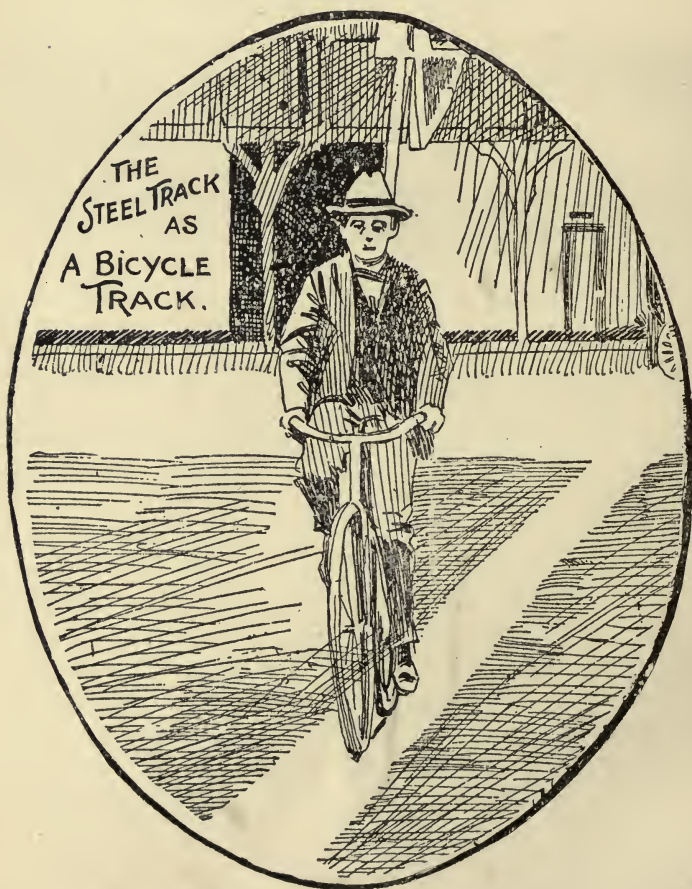
A German Substitute for Granite Blocks or Asphalt.

The Germans are endeavoring to cut down the expense of first-class paving by producing a cheap artificial stone as a substitute for the ordinary granite, or our familiar asphalt. One such block, said to be successful, being introduced, is made of a mixture of coal tar and sulphur, to which, after it has been thoroughly warmed, some chlorate of lime is added. After cooling the mass is broken up into small pieces and crushed, blast furnace slag added, and the whole subjected to hydraulic pressure.

The blocks produced are said to be equal in durability to many stone roads, the resistance to wear and tear being about half as great as Swedish granite. They are practically noiseless, give the horses a good foothold and are clean and easily kept so.



Dr. Camp's Machine
For spreading oil on wagon roads.



Thos. H. Gibbons, C. E., Inventor.

OIL, ON ROADS.

Southern California should have the credit of first making dustless roads, by the use of crude oil. The idea first originated in Los Angeles county, where many miles of dusty roads were treated with satisfactory results, having been made absolutely dustless at all times.

The idea originated with F. W. Mattern, of Los Angeles, who, after experimenting ten years, obtained letters patent. L. B. DeCamp became interested in the patent, and it is through his efforts that the usefulness of the oil process for dust-laying has been demonstrated in Los Angeles and San Bernardino counties, California.

The machine for distributing the oil on the roadway is quite a novelty. It consists of a portable tank, six feet long, running on two wheels, which are attached to the rear of an oil tank wagon. The oil is discharged through tubes six inches apart, underneath the tank, which are operated by a lever. Only a sufficient amount is let through to take up the dust. The oil is run in furrows made by a little hoe, and is covered by other hoes following. This is to prevent the oil from seeking a level in any low place and becoming unevenly distributed on the road. After all the oil has been applied, the same machine is used to incorporate the oil and earth. Two horses are attached to the apparatus, and by means of numerous other friction teeth and by going over the road the balance of the day for the purpose of incorporating the earth and oil the road is made ready for use. The oil used is a heavy quality of asphaltum oil and is applied hot. The affinity (the earth for the oil) when both are hot is very great. The amount of oil required varies between 50 and 60 barrels per mile for the first general treatment. Subsequent treatments require about 20 barrels per mile. A road having an ordinary amount of travel requires three applications to keep it in good order. The first application should be made as early in the spring as possible, at any rate, as soon as the dust has become hot from the action of the sun.

To get the best results a good foundation is necessary, although the dust can be laid on roads having no foundation, but the expense is greater.

One of the principal streets of Long Branch was treated with the oil process, and reports concerning it are generally satisfactory, sections of the street with a good foundation showing perfect results and a dustless driveway.

The following from the South Pasadena will show how the oil process is viewed by the people of that town :

"The city trustees and the people of South Pasadena are so well pleased with the results of allaying dust with oil that if the rainy season were not so near, the plan of using water for this purpose would be abandoned entirely and the dust kept down by the use of oil. Our people are so well satisfied with the result of dressing a portion of the roadways with oil that they regard it as the solution of the question of street sprinkling. In the spring the use of water will probably be abandoned altogether and oil substituted. The dust by this process is entirely allayed, the cost much less, and what is of equal importance, a great saving in the water supply is made."

After a thorough investigation and practical working of the oil process as applied by Mr. DeCamp during the past six months, there seems to be no question as to its utility and economy over the ancient custom of watering the roads to allay the dust. This being the case, we hope, for the good of the travelling public, that the oil dust-laying process may be adopted throughout the country.

The oil and dust form a water-proof elastic covering, which prevents water from penetrating below the surface, and also prevents wasting during heavy rains.

This elastic covering also protects the foundation from the grinding wear of the wheels, all of which reduces labor and saves material for repairs.

The elastic cushion formed by the oil and dust greatly overcomes the noise made by passing vehicles. Of its application to stone roads Mr. L. B. DeCamp writes as follows :

"Stone macadam roads newly made, after being rolled and

when dry, if treated with an application of asphaltum oil (or residuum oil) which has been heated to the boiling point, it will penetrate into the roadbed in a very few minutes, and will be ready for travel the next day. The oil should be put on evenly so as to give a uniform distribution, and only as much as can be quickly absorbed. A little experimenting with oil and sprinkling pot will demonstrate how much to put on. A roadway of this nature soon becomes almost as hard as an asphaltum pavement. The presence of oil on the surface makes the roadway dustless and prevents the roadway from grinding up and blowing away. If kept continually under this influence a roadway is practically indestructible, that is, in regard to the road material. It stands to reason if a roadway cannot grind up and blow or wash away, it would never have to be renewed; it would be a question of oil instead of gravel or stone. If the road is made of stone alone it should be covered with some loose gravel or bitumen, then rolled solid. A roadway of this nature is entirely impervious to water, and, if so, would never freeze; consequently, no thaws or mud. The roadway could be treated as often as required, say two or three times during the year, beginning as early in the spring as practicable and finishing in the fall, so the roadway would be in good condition to stand a winter's rain and snow.

SUCCESS OF OIL, ROADS.

A perfect country road whereon the noble steed
Can draw a broad and ample load at pleasant rate of speed,
One hard and smooth and level, yet so drained and hard and dry,
It won't be muddy when it's wet, nor dusty when it's dry.

Roads like schools tell the tale of the degree of civilization. No highly civilized people will be content with highways filled with chuck holes and hub deep with the disgusting mud of winter and the destructive dust of summer. For such people will prize at the true worth the expedition, the cleanliness and comfort, yea, the absolute pleasure and the economy in the wear and tear of vehicles passing only on the smooth, firm roadbed, incapable of conversion into either mud or dust.

Below will be found extracts from various publications commenting upon the result of using oil upon roads in different localities.

The elastic cushion-like composition formed by the oil and dust makes it easy for the horses' feet and delightful to ride the wheel over, giving back but a softened noise when traversed by vehicles and horses. Its use is commanding generous popular commendation and patronage, not only making the roads pleasant for riding and driving, but promoting industrial economy in every town and road district. There is not a property owner but what is interested in the use of oil on roads. Decent roads are value lifters. Dustless roads mean dustless houses, shrubberies and trees. They save paint and labor, therefore, money. One of the chief deterrents to country life has been in the positive discomfort imposed by journeys over the average country road. Dustless roads will increase the value of land and make farm life fifty per cent. more comfortable. More than one thousand miles of Eastern railways are using oil.

The city of Redlands, Cal., has fifteen miles of its streets dustless from the application of oil. So popular is the estimate of its value that bankers and property owners gladly pay the expense of using it outside of their regular tax. Over one hundred miles in the southern part of California have been covered with it and in every instance pronounced a success, and over one thousand miles will be placed under contract for the coming year. When a road has once been put into condition with oil it requires but slight additional expenditure to keep it so. It has been found that where the road had a fine, hard foundation, smooth and clear of ruts the oil is a complete success. It gives a surface as polished, clean and clear as an asphalt street. It prevents the destruction of the road by resisting the formation of mud. It prevents the earth from becoming saturated with water. When applied to hard surfaces it packs readily. One hundred barrels of oil per mile spread over an area of eighteen feet in width will put a road in condition along the extent of the road surface and give an excellent roadway, adequate for ordinary road traffic. One saturation succeeding the first three treatments will keep the road in

repair during a year, and its application requires but twenty barrels to the mile. To allay dust with water it must be constantly applied if the dust is to be kept down. With the oil one application does the business for months, and there is no mud alongside the carts to be seen. The oil holds down the dust in all cases where there is any good foundation to the road. The testimony of wheelmen is that under their tires the roads become packed-down and are smooth and elastic, and that tires will last longer on oiled roads than any other. In South Pasadena, California, the people are so well pleased with the results of laying dust by oil that they are considering the abandonment of water entirely. In the spring the use of water will probably be abandoned altogether and oil substituted. By this process the dust is entirely allayed and the cost is much less.

In the application of oil the rain will not sink through the oil surface of the roadbed, and if there are hollow places in the surface of the oiled road, the rainfall will lie there until it evaporates. The affinity of the oil for the earth is reputed to be so great that an hour or so after the road has been sprinkled with oil no traces of grease can be found upon the shoe soles of a person walking upon the highway, and no injury whatever is done to the tires of vehicles. The economy and ease with which oil can be applied to the surface of our dusty or muddy highways promises a relief from the nuisance of bad roads in those sections of the country where it has not been found possible to build stone roads. When a dirt road is exactly in the right condition it is superior to any stone road that can be built because of the absence of noise, the absence of shock and injury to the horses and the smoothness of the surface, but the dirt road is almost never in exactly the right condition. If an infrequent sprinkling with oil will keep it so then a simple but most important discovery has indeed been made. It has been found that a macadamized road after being oiled does not lose its top dressing and that practically none of the fine stone is carried away by the winds. It remains in permanent repair longer than the road not so treated. Mr. Richart drove over a ten mile oiled road out of Bryn Mawr, and over another boulevard, an oiled hard dirt road in Chester county, Pennsyl-

vania, and both were in fine condition. In California oil has been applied to roads having four or five inches of dust with fine result.

By the Hon. E. G. Harrison, U. S. Road Expert.

The original New Jersey State Aid Law was enacted and approved March, 1891, entitled. "An act for the more permanent improvement of the public roads of this State." The law has been amended by several supplementary acts, but the main features remain the same. New Jersey has the honor of being the first State to aid in the construction of public roads by appropriations of money from the State Treasury. Heretofore the roads had been considered local affairs. Their supervision was entirely under local authority, excepting where, by special legislation, county authorities were empowered to act. The money raised for their construction and maintenance was raised by taxes on property in the township through which the roads passed. In addition to this, when a new road was laid out for the use of the public the damage for the right of way had to be assessed on the property in the township where the road was built; thus the burden laid on the property owners of districts as small as a township was so great that the extra tax for improved permanent roads would make it entirely too heavy for the property owners to bear.

The State aid act was a new departure. It recognizes the fact that the highways are the roads of the public; that all people have the same right to use the roads, regardless of where they live, as the people who live in the locality where the road is laid and who pay for the right of way and are taxed to construct and maintain them. The cost of road construction under the State aid act is so distributed that those who use or are benefitted by the use of public roads shall pay a proportion of the cost. In order to do that as fairly and equitable as possible, the act provides that the property owners along the road improved shall pay ten per cent. of the whole cost of the road as peculiar benefits. The State pays one-third of the cost and the balance is paid out of the county funds. The State revenues are raised principally from corporation franchises and licenses. In this way people are not taxed for the State's donation. The distribution of the cost has worked

so well in practice that the opposition to the law has subsided. The law makers of other States have examined the New Jersey State Aid Law and its workings, and the result is that several States have adopted the principle of the law, modifying to meet their own conditions. The States of Massachusetts, Connecticut, New York and Rhode Island are now working under State aid laws. These States sent commissions and legislative committees to New Jersey to examine the workings of the law. North Carolina, Virginia and Maryland have done the same with a view of getting information in regard to the State aid system. The Road Inquiry of the National Department of Agriculture, whose duty is to gather information in regard to road construction and the laws best calculated to promote road improvement, after a careful examination of the New Jersey State aid system and its practical workings, has published bulletins in which the principles of the law are set forth, giving account of its practical workings and commending it to the consideration of the friends of good roads throughout the country. The result of this has been that Governors, State Legislatures and State officials send to the Department of Agriculture asking for the services of lecturers and experts to give information in regard to the workings of the New Jersey State Aid Law. The appropriation for the Road Inquiry has been so small that only one expert has been employed for that purpose. His report to the Department for the last year will show he has addressed six State Legislatures, ten City Councils and Boards of County Commissioners, fifty-three State and Congressional District Conventions, forty-five Farmers' Institutes, sixty-five meetings of Boards of Trade, club associations and special meetings, all in the interest of the good roads movement. At these meetings the principles of the New Jersey State Aid Law formed an important part of the subjects discussed. Surely the framers of the New Jersey State Aid Law built better than they knew at the time. The addresses were delivered in eighteen different States, and the expert in reaching the places where the addresses were made has travelled over thirty thousand miles.

This statement is made to show the great interest the country

is taking in the good roads movement, and the desire to have information regarding the principles and workings of the State aid system.

HOW GOOD ROADS ARE BUILT AND MAINTAINED IN GERMANY.

The roads in Germany are all subject to a much heavier wear and tear than at home, for not only is the population denser, but also the agriculturists, living all together in villages, seldom having their land in one piece, but in many scattered plots, have to do a large amount of carting—manure, crops, etc.—back and forth over the public roads, whereas our farmers, dwelling in the midst of their acreage, do most of their carting over their own fields.

All roads, excepting those streets that are within towns, are divided into classes, viz.: state and county roads. The State roads are the most important thoroughfares, connecting the larger towns with one another, and are built and maintained entirely by the central Government. The county roads are those which, connecting the smaller villages, are built by the county with State assistance, up to two-thirds of their cost, but thereafter are entirely maintained by the county.

The general way of building is about the same for both classes of roads, except that on State roads, which have the heaviest traffic, the best of material is used without regard to cost, so to say; whereas, on the county roads material from local quarries is frequently used. The traces and levelling for a new road being completed—the maximum grade allowed is 6 per cent., though in some unavoidable cases it can rise to 9 per cent.—the ground is excavated in the desired macadamization width to the depth of 14 inches; herein are planted the rough quarry foundation stones, rising from the sides to the middle, so that the arch of the completed road shall be one-fortieth of its width. Upon this foundation crushed basalt or granite in pieces of a cubic inch is strewn to a depth of from four to five inches, upon which, as top dressing, shell lime is liberally strewn before and during the wet pressing by the steam roller.

The roadbed being so completed, a gravel footpath of about one and a half yards in width is made on one or both sides of the road. Alongside of these paths runs a ditch as deep as the roadbed, which receives the water from the road through gullies at short intervals. A fruit, generally apple tree, being now planted at every twelve yards, as also one hundred yards, and milestones, the road is entirely finished.

These State roads vary in width from six to twelve yards, the average width being seven and one-half yards. The average cost per mile is \$10,000. For every mile and a half of completed road a road keeper is engaged, who receives wages varying from \$125 to \$200 per year. His duties are to mend all small ruts, to brush the road in dry weather or scrape it in wet at least once a week, also to keep the footpaths, ditches and everything pertaining to the road, in a most perfect condition, which duties occupy him about six hours per day throughout the year. Special rewards are given to those who are most painstaking. For every fifty miles of road there is an overseer, with a salary of from \$400 to \$500, whose duty it is to watch over his piece of road, report as to repairs continually. For each county there is a State (road engineer) inspector, who reports finally to the superintendent of roads in the Ministry of the Interior. The inspector's salary ranges from \$700 to \$1,000.

The annual repairs on State roads average \$240 per mile, varying, according to travel, from \$1,100 to \$128 per mile. The maintenance of the county road is based on the same plan as the State roads, except that being narrower (the average width is five yards) and generally having no footpaths, a road keeper has about two and a half miles to keep instead of one and a half by State roads. The average cost of building a county road five yards wide is \$5,000 per mile. The annual repairs average \$55 per mile.

RAILWAYS ANXIOUS FOR GOOD ROADS.

Notwithstanding the popularly accepted theory that all corporations are soulless, it must be conceded that railway corporations have been the pioneers of progress in this country, and have not only blazed the pathway to our wonderful development, as pioneers are generally credited with doing, but have actually constructed the highways that the great cavalcade of civilization may follow without obstruction or hindrance.

The public spirited directors of these great combinations do not build alone for the present. They realize that on the prosperity of the people depends their own, and they know that the vast wealth of the Western Empire will soon turn the tide of traffic that has so long found its market and its outlet on the Eastern seaboard to the golden ports of the Pacific for shipment to Asiatic countries and the islands of the sea. They know, too, that nearly every pound that goes to foreign markets must first be hauled in wagons over Western prairie roads, and that the producer must first have his profit before the railroad can get the produce to transport.

This is why they are so willing and so enthusiastically aiding this great movement. It is a business proposition with them just the same as the farmer and merchant should make it. It is not philanthropic effort that levels forests, opens mines, builds cities and founds governments among men. It is a struggle of individuals severally and collectively to better their own condition; it is an effort to accumulate dollars.

One general passenger agent of a great railway system, in pledging the co-operation and assistance of his road, closes his letter by saying: "While on this line, I would like to state that there is no one movement that is of grater value to the railroads than the work you are doing. I wish you every success."

TRANSPORTATION.

Transportation is one of the most important problems occupying the minds of people to-day. Capital has been energetic in improving the larger means of transportation as open carriage, canals and railways, while the arteries and veins leading to and from these have been sadly neglected, with the result that one ton of freight can be carried by water for a thousand miles or more and by rail two hundred and fifty miles for the cost of moving one ton only five miles over the common roads. New Jersey has twenty thousand miles of country roads and about one thousand miles of railway in which an immense amount of capital has been invested; yet it will scarcely be contended that they are of more importance to the country than the common highway. Had an equal amount been spent upon the common roads this State would have been the best paved one in the world. Bicycles, electric railways and automobile carriages are being universally adopted as convenient means of travel. They are all beyond the experimental stage and the great utility of the automobile has been demonstrated. So many factories are being started and so much capital entering into their construction that they will be soon offered at a price that will be within the reach of all. Their use will accentuate a still greater demand for road improvement. They will afford cheap and convenient transportation for both the country and town people. The electric roads will exercise a beneficial influence by drawing population to the country; this population will need better roads. All the increased freight necessary from increased population will need increased means of conveyance to different centres. Automobiles coming largely into use will be road makers instead of road breakers. Free and uninterrupted intercourse for the farmer will advance the intelligence of the farming community and will create for the farmer more ways of money making. Great prosperity and refinement bring greater needs. Along the highways will flow wealth and culture, to be participated in by the villages, towns and cities. The value of agricultural land is shown by experience

to be in direct ratio to the condition of the roads by which it is reached. With no roads land has no value. Distance is measured by time and ease of travel, not by miles. Land situated one mile from the market town with a bad road intervening is frequently of less value than an equally fertile property ten miles from the market having good roads communicating with it.

A TRANSCONTINENTAL ROADWAY.

Thackeray said, speaking of railroads, that we no longer travel—we arrive; and he might have added that by thus arriving without travelling, we lose many enjoyments and experiences which more than counterbalance the gain in time. Railroads confine our knowledge of a country almost entirely to the various stations on their routes; for the glimpses of the landscape as we sweep along the tracks amount to no more than a topographical impression; all human interest, and intimate acquaintance with the countless details of scenery and characteristic features are out of the question. And though the Californian can to-day visit New York, and the New Yorker journey to San Francisco, at a cost of time and money comparatively insignificant, yet such visitations do not accomplish much real increase of mutual knowledge. The visitors “arrive” with their local atmosphere and notions still about them, and are gone again before they have had a chance to enter sympathetically and intelligently into the new conditions and ideas. They go to sleep in one place and awake in another; and the educating and cultivating influences of travel are mainly missed. How much people could learn if they spent months at one another’s homes! No man can tell us all about himself; the environment in which he was born and brought up adds materially to our knowledge of him, conveying facts which he would not know how to communicate. But this finer knowledge is a closed book to a railroad generation: the train pauses for a moment at a station, and we look out and see a line of figures staring idly up at us from the platform; and then they vanish and we forget them. We have seen them, but they are as much strangers to us as they were before. How do they live? What

are their occupations, their thoughts, their ideals, their griefs and pleasures? Has our fleeting glance in any respect deepened or broadened our comprehension of the American people, or strengthened the bonds of sympathy between one part of the country and another?

And yet such comprehension and sympathy are urgently desirable and expedient, if this Union is to grow into a homogeneous and vital organism. Interstate commerce—freight trains and drummers—are well enough in their way; but they alone will not suffice to make the American people a unit. The press, with all its thousands of local correspondents, will not do it. No: What is needed is a sort of quiet, uncommercial, social circulation of the inhabitants of the land among one another's homes and birthplaces. There should be no hurry; no breathless eagerness to get as soon as possible to a certain spot and get back again; but a humane and self respectful purpose to jog comfortably along, with the eyes and the heart open, seeing, feeling and comprehending whatever we meet. We should travel, not for financial gain, not to traffic with our neighbor, thus coming in contact with him on his hardest and least congenial side; not to take snapshots at him, either photographically or figuratively; but to know him, to be friends with him, to chat with him, to tell him and ask him homely, domestic, kindly things. How are we to bring about this agreeable condition? It is, in a word, having marked out whatever route would be most agreeable and expedient, to build a magnificent boulevard clear across the continent, from Boston or New York to San Francisco or Los Angeles. And after this is done, and has proved its value, build others, three, six, a dozen of them, grilling the continent east and west, north and south. Bring out now your bicycles, tandems, automobiles and driving wagons, and for the first time in more than a generation, do some real travelling. Get on your walking boots and learn for yourself the secret of the fascination which keeps the army of our tramps recruited year after year. Investigate this superb continent of ours for yourself, at your leisure, intimately, reasonably, deliberately, enjoyingly, pausing where you like, detouring where you will. Make yourself a cosmopolitan of the American cosmos; it is big and beautiful and interesting enough

to make you forget the beaten paths of tourist ridden Europe. Learn by practical and personal experience the true lessons of human democracy—not the political scarecrow, but the warm, flesh-and-blood fact. When the railroad train rushes shrieking across your path, with its smoke and cinders and uproar, and its blase, weary, porter-ridden, ticket-enslaved, time-table-devastated, railway-novel-skimming, self-centred passengers, watch them scurry soullessly over the horizon, and thank God that you have been restored to sweet, reviving companionship of our mother earth, and to normal relations with the kindly human creatures that inhabit her. Noiselessly, smoothly, rejoicingly you journey along, striding out or wheeling, as the case may be; you smell the breath of the fields and woods, you pause at the bridge to see the river slip gurgling away, you halt on the hilltop to trace the great highway winding amidst the green behind you and before; you reflect with delight that you are in the heart of Virginia, of Kentucky, of Colorado, of California; you look forward with content to the hospitality of the cool-veranda's roadhouse at noon, and to sound sleep in the comfortable wayside inn or eleemosynary farm-house at night. Here comes a native of the State; stop and talk with him; what does he think of the National Boulevard? Yonder in the farm-house porch stands the farmer's daughter; wave her a greeting, or beg a glass of milk of her. And here approaches an uncommercial traveller like yourself, returning from the place whither you are bound; you may exchange notes and impressions with him. "It's a great country!" he remarks, as you resume your diverse ways. It is not the repetition of an empty formula, but a conclusion from living experience, acquired on the great Boulevard.

Assuredly there is nothing new in the idea of national highways. Darius connected the eastern and western frontiers of his empire, 2,700 miles apart, with great military roads, and they were great life arteries to his empire. The great empire of Alexander was made possible through their roads. The ancient Romans bound their empire together with them, and two thousand years have not yet effaced the titanic traces of them. There was a highway out of Egypt into Assyria; and the vast kingdom

of the Peruvian Incas is traversed from end to end by roads so masterfully built that they are still the marvel of engineers, struggling to hang their iron rails round the necks of the Andes.

Railroads may civilize a planet, but it is roads that are not railroads that humanize it. Bunyan's Pilgrim might have ridden to the gates of the Celestial City in a limited train, with his Burden in the baggage-car; but when he reached his destination, he would have found difficulty in gaining admittance. To learn the lesson of life, we must live it day by day from the beginning to the end; and to know the land we were born in, we must study it otherwise than by donning the thousand league boots of an Empire State express, or a Sunset limited.

Our great American Boulevard is to be the king of its kind. Every resource of the engineer's art is to be lavished upon it. It should be not less than two hundred feet wide; two hundred and fifty feet would be better. It should be free at all times alike from dust and from mud; it should be planted from end to end with trees—the characteristic trees of the several States through which it passes—a hundred feet apart one from the other. There should be a path for pedestrians, two for bicycles, two roadways for automobiles; and a riding path for horsemen might be added. At intervals along the route there should be wells, artesian or otherwise, each with a shady pavilion and benches. At intervals, also, there should be road-houses, supplied with necessary refreshments and facilities for rest; and regular inns, fitted out with every accommodation. All these should be connected by telegraph and telephone lines, so that quarters could be provided beforehand, and communication maintained between any given points.

The route which the Boulevard should pursue is a subject for discussion. We do not have to pick out the shortest; that necessity we leave to the railroads. We are not to lay a ruler down on the map, like Peter the Great of Russia, and insist that our road shall not depart from the line marked by the ruler's edge. The curve of beauty may be present in it at all points; charm and variety of scenery should be carefully considered, and attention given to the claims of the various States through which it might

be led. The road is built for pleasure and education, not for business; and the object of those who use it is, once more, to travel, not merely to arrive. Nevertheless, the indirect advantages to commerce of the road would be great, and constantly augmenting; because people who know each other deal more readily than those who are strangers to one another.

The outlay for the road would be enormous; but the weight of it would be so distributed as to be burdensome to none. Each State would build its section, the legislatures voting the needful supplies; and contributions could be accepted from rich individuals who might choose to show their public spirit in that manner. The inns and road-houses and other appurtenances should be of the first quality, and under constant inspection; prices should be kept as low as the quality of the accommodations admitted. The road must be absolutely national; free to all, without fear or favor. Money contributions, whether State or individual, should carry no special privileges to the donor; the great Highway must be democratic in the fullest sense of the word.

To build such a road, upward of three thousand miles in length, is a mighty undertaking; but no great time would be necessary to accomplish it. Once the route has been planned, and the character and quality of the work determined, each State and county could set to work at once, and the road would spring into existence at all points simultaneously. The number of laborers who would find employment would be vast; it could easily reach a million. If the preliminary surveys were to begin to-day, it would be conservative to expect the first automobile or bicycle to make the trip across the continent three years hence.

Not only would our Boulevard become the favorite plaything and pastime of our own people, but innumerable visitors would come from over the seas to see and use it. The annual hegira to Europe would markedly diminish, and on the other hand Europe would begin to come to us, eager to enjoy an entirely novel experience of inexhaustible fascination. The money thus kept from going out of the country, and that brought into it by foreigners, would in a few years go far toward defraying the cost of building the road. The manufacturers of bicycles and auto-

mobiles, alone, would find their reward in becoming the largest subscribers to the enterprise. For what an elysium for bicyclers and automobilists would the road afford! Where one person uses a machine to-day, ten would do so before the road had been a year in operation; and with supply shops at every few miles, there would be no chance of delay from breakdowns at any point of the stupendous route. Large excursion parties would forever be travelling in one direction or the other; but there need be no crowding on a thoroughfare of such imperial length; and those who craved solitude or select company would never be interfered with.

So here, my countrymen and countrywomen, is the idea in bare outline. It remains for you to fill it out, and put it into execution. The sooner you set about it, the better; and on the day when a clear and flawless path, free to all the population, is opened from our west coast to our east, we may credit ourselves with having made a distinct step forward in human development.—
JULIAN HAWTHORNE, in November *Cosmopolitan*.

An enthusiastic automobilist has recently revived a proposition which was advocated a century ago, but has laid dormant for many years. It is for a government road from New York to Chicago, and possibly to the Pacific. This road is to be suitable for bicycles, automobiles, and light carriages. Asphalt is spoken of as the most suitable pavement for the rubber tired vehicles. The main road would be through the most thickly settled sections, with branch roads leading to important points in the neighborhood of the route. The proposition at first seems great and the cost unsurmountable, but when it is considered what the combined efforts of the various cities benefitted could do, the proposition seems more feasible. The great work which has been accomplished by the bicycle riders of this country for the improvement of the highways is certainly wonderful, and shows what is possible when the energies of a large number are concentrated toward the same end. Such an enterprise would not encroach upon the business of any company, since its purpose would be entirely identified with the new industry.—*The Automobile*.

THE GOOD ROADS MOVEMENT IN POLITICS.

It seems probable that the success of the League of American Wheelmen in persuading different States to contribute aid to the building of public highways, may induce them to move towards enlisting our National Legislature in making appropriations for great national highways. Their thorough investigation into the cost of hauling farm products over country roads as they now exist, comparing them with the condition of the improved highways of Europe, demonstrated that the cost of transportation was several times greater than it would be over good stone highways. This persuaded the farmers, who at first strongly opposed on account of their supposed cost, to petition for some experimental lines, which proved to be so satisfactory they have enlisted the farmers in almost a solid phalanx in conjunction with them instead of against them as at first. It is possible that still further concerted movements for both State and National legislation will be made by causing the insertion of good road planks in the party platforms, thus making it of such importance the politicians of all the great parties will understand that it has such a tremendous backing they will not be able to resist the insistence of three millions of wheelmen and the many millions of farmers for an improvement that overpowers any other subject claiming the attention of Legislators. It is claimed that five hundred millions is wasted every year because of the wretched condition of our highways; therefore, it should not be long before good roads will become a political issue. It is one of the greatest economic questions with which the country has to contend. Besides, the great capital engaged in automobile construction is rapidly coming to the front to enforce the demand of the farmers and wheelmen. In all States where appropriations have been made and improvements made under them, the desire for hard roads has become so great that it would not be political policy to oppose State donations for their construction. Already a bill for the National Government to donate \$5,000,000 to the States for macadamized roads has been introduced into Congress.

RAILROADS VERSUS MACADAMIZED ROADS.

Transportation underlies material prosperity in every department of commerce. Without transportation commerce would be impossible. Those States and nations are rich, powerful and enlightened whose transportation facilities are best and most extended. The dying nations are those with little or no transportation facilities. There should be amicable relations between the commercial, agricultural, industrial and transportation interests in the United States.

American railroads to-day furnish the best service in the world at the lowest rates of fare, and their passenger cars give the greatest comfort and convenience of any other nation.

It is not an infrequent occurrence for a single engine to haul through the Mohawk Valley eighty-five to ninety thousand bushels of grain in a single train.

The total railroad mileage of the United States is nearly half as much as that of the entire world, there being 182,776 miles of railroad exclusive of side trackage in the United States, as against 436,240 miles for the entire world, or 253,474 miles for the balance of the world.

The tons of freight carried by the railroads of the United States are more than one-half of that carried by the railroads of the world.

There are about 1,500,000 miles of public roads in the United States.

Many States have more than 100,000 miles.

While the railway and steamboat systems of transportation have been developed with great rapidity and in a way that reflects credit upon the enterprise, skill and energy of the men who have promoted them, the ancient and more necessary means of transportation afforded by the ordinary wagon roads has remained in a state of shameful neglect. Thus while national and international intercourse has been vastly increased by railroads as regards speed, safety and cheapness, the highways which are tributary to them are, as a whole, in no better condition than they

were fifty years ago. We own and operate more miles of bad wagon roads than all the remainder of the world.

We would have the farmers keep in mind the fact that ninety-nine per cent. of every load by railroad or steamboat must be first carried in a wagon or truck over a highway, and that every dollar of this cost comes out of their pockets as a part of the cost of production, that every cent of reduction in the cost of transporting their products to the railways and rivers for shipment, by reason of improved highways, is so much addition to the profits gleaned from their labor. When they understand this they will see the force and necessity of this great campaign for better roads.

HARD ROADS AND FREE MAIL DELIVERY.

The tendency of population is so strong towards cities that every movement that holds the inhabitants of the country to rural life should be hailed with delight, and there has been nothing in the history of the postal service of the United States so remarkable as the growth of the rural free delivery system along the line of good roads. The building of good roads has made the free delivery system practical, and the promise of the free mail delivery has stimulated a general improvement of the condition of the roads to be traversed by the road carrier. Besides, it has brought a better price for the farm products by bringing the producers in daily touch with the state of the markets, thus being enabled to take advantage of information heretofore unattainable. Then, too, it has been of great educational benefit in relieving the monotony of farm life, giving ready access to wholesome literature, and keeping rural residents, the young people as well as their elders, fully informed of the stirring events of the day. Rural free delivery has for its main purpose the advancement and education of the people, and to bring the postal service within their reach. It saves the farmer the long drives to the post-office, sometimes eight or ten miles a day. One Missouri farmer calculated that in the last fifteen years he had driven twelve thousand miles going to and from the post-office to get his mail, all of which travelling is now saved him by free mail delivery.

All those interested in the development of good roads throughout the country have shown a strong disposition to lend a helping hand to the rural free delivery service, recognizing the fact that good roads and rural delivery are necessarily closely connected. Facilities for daily contact with the world's best thought and progress should be accelerated. The highest social, financial and intellectual success cannot be obtained until we have good thoroughfares and free mail delivery. Rural free delivery of mail so much needed among our farmers can never be obtained except in localities possessing good thoroughfares, insuring rapid transit at all seasons of the year. If the thousands of tons of trashy stuff costing the government millions of dollars for transportation were debarred from the mails and the money devoted to free rural routes, the farmers could take daily papers, and tens of thousands of our home daily newspapers, with all of their elevating, refining and educating influence, would find their way into rural homes. By the daily paper the farmer is enabled to keep in touch with the world's advancement, to be posted on current events and to understand the daily markets. Nothing will do more to hasten this desired end than good roads. The farmer's family must be kept in close touch with the world's thought and action or they will migrate from the country to the already overcrowded cities. The extension of the rural free delivery service in Great Britain has resulted in an increase in the number of letters mailed amounting to the enormous total of fifty millions of letters per year. In several sections farmers report that a free delivery service increased the value of their farms. Rural free delivery promises to settle the question "how to keep the boys on the farm." Rural free delivery, good roads and the telephone are proving wonderful agencies in driving away the daily monotony of farm life, bringing the comforts of city life to the farm homes and gladdening hourly the hearts of all. Where routes for free mail delivery have been longest established it has tended to increase settlement along the same. Farms and houses formerly tenantless find tenants and occupants. Land values have increased where the daily papers are delivered and brought every day. Improved roads are bringing into sev-

eral districts of our State free mail delivery, and urgent applications are pending for more carriers in the populous sections around Mooorestown. Palmyra, Mount Laurel, Riverton and Marlton. The mails are heavy and the work of the carriers laborious. With additional carriers the service would be well-nigh perfect. There are now eleven routes established in New Jersey, running in a systematic manner and giving perfect satisfaction to the patrons. Since their establishment the first and second class mail material has greatly increased, and has become the means of bringing the farmers and people along the route in closer communication with the outside world, a privilege which when once enjoyed they will be slow to abandon. This form of distribution is assuming great importance in our State, because of the numerous hard roads that now radiate in many directions from our central towns. With an improved system of highways we can not only have a perfect postal system, which not only includes free delivery of letters, but parcels also from house to house throughout the State. With good roads and automobiles we can have a one cent letter post and a very cheap parcel post rate on packages of one hundred pounds, and less on smaller parcels, that will be sufficient to pay for circulation and delivery from house to house of all kinds of parcels, including baggage.

This is surely a consummation devoutly to be desired, and it seems almost within the grasp of the rural districts on account of the numerous hard road trunk lines that are now radiating from many railroad centers in our State.

IMPROVED ROADS VERSUS IMPROVED SCHOOLS.

One of the most beneficial results of road improvement is the facility it gives to consolidate country schools and thus concentrate our children into central buildings, so making graded schools possible in our country districts. In travelling around the State we have noticed that where improved roads exist the children, by means of bicycles, easily go long distances to central schools; thus graded roads make possible graded schools, the improved roads working in harmony with the State Educational Law, giving the children of the rural districts the same



Electric Stanhope,
Fisher Equipment Co., Chicago. Wood motor "The Hub."



Electric Break,
Fisher Equipment Co., Chicago. Wood motor "The Hub."

advantages as those residing in cities. Last year forty-four Connecticut towns, by means of improved roads, were enabled to give free transportation to a large number of their pupils. Eighty-four small schools were closed and eight hundred and forty-nine children rode to the central schools. The cost of transportation was about \$12,000, but a gross amount of some \$20,000 was saved, leaving a net saving of some \$8,000. This saving was but a small part of the benefit derived, for it resulted in a better attendance and better schools. This close co-ordination between improved roads and education cannot be too strongly impressed upon the public attention.

THE EVOLUTION OF THE AUTOMOBILE.

The general introduction of the automobile must be followed by an unprecedented development of good roads; therefore, we publish the following facts, gathered from various sources, which demonstrate that we cannot too rapidly improve our common roads, in order that the vehicle of the future can have easy propulsion through all sections of our beautiful State, thus showing desirable resident sites to home seekers.

“Five years ago there were not thirty self propelled carriages in use in all the world. A year ago there were not thirty in America. In about one year companies with an aggregate capital of over four hundred millions were organized in New York, Boston, Chicago, Philadelphia and other cities, for the sole purpose of manufacturing and operating these new vehicles. A set of financiers are organizing a corporation to take over automobile factories in this country; another set of promoters are evolving a scheme for a gigantic consolidation of vehicle companies, with a capital of \$200,000,000, to deal in automobiles in America and England. Ninety establishments are now actually engaged in building carriages, coaches, tricycles, delivery wagons and trucks, representing several hundred types of vehicles and nearly half as many methods of propulsion. All manufacturers are overwhelmed with business; one company is working day and night on an order of five thousand vehicles. Now, a device has

been patented to convert all old-fashioned vehicles into automobiles; cabs under different methods of propulsion can be seen most anywhere, and they have become a practical necessity, and yet the whole development in this country is far behind that of France and England. France has an automobile club numbering two thousand members, occupying a club house costing \$440,000, and at its last exhibition over eleven hundred vehicles were shown, and some of the expert drivers have ridden thousands of miles in their road wagons and have climbed mountains and raced through half of Europe.

In Paris they have become as familiar as old-fashioned horse cabs. In the country districts thousands of grocers, milkmen, market men, and peddlers are the engineers of their own gasoline carts. The French Minister of War is numbering and describing every vehicle of this kind in the Republic, and has quietly arranged to seize them for military purposes when France shall go to war. Several powerful associations are devoted to its development and a large number of vehicles are in actual use. France leads in gasoline vehicles, England in steam vehicles and America in electrical conveyances. The prospective buyers of many thousands of them in America is confronted with the bewildering variety of models which the manufacturer places before him. The best modern motor vehicle is practically noiseless odorless, and nearly free from vibrations. It is still clumsy in appearance, but invention is rapidly lightening it. Its mechanism is so simple that anyone can learn to manage it in a few hours. Seven different motor powers are now employed in this country. Electricity, gasoline, steam, compressed air, carbolic acid gas, alcohol and liquid air, the first three with great success; the others are in an experimental stage.

The utility of the automobile will be in direct proportion to the condition of the roads upon which it is intended to travel. Manufacturers are receiving the greatest number of inquiries from localities where the pavements are good. It has great acceptance in France because the highways are all as smooth as park paths. Bicycling already has had a profound influence in spurring the road makers, and the introduction of the motor vehicle will be

still more effective. The automotor has come to stay. It must now be rated as an accepted and established appliance of everyday life. Its universal adoption is inevitable and probably very near. Attractive magazines are being published monthly in the interest of the automobile, while the daily papers teem with articles denoting its progress. The distance an automobile will travel with one charging is dependent upon the capacity of the power material used. From twenty-five to one hundred mile runs are reported with one charge of electricity and gasoline. Most motors now recommended for road vehicles can be driven at any pace up to the speed of an average trotter, and the day of automobile racing has already arrived in France and will not be long delayed in other countries. It has been practically demonstrated under test of actual work of great severity that new machines may work in commercial competition with railway rates with loads up to four tons and over, distances of from thirty to forty miles. Frequent trials have shown that the use of automobiles is not more dangerous than that of horses, for a record of six weeks showed that 476 runaway accidents by horses occurred, and 36 persons were killed and 290 injured. They are not as liable to break down. The expense of keeping up, as well as the cost of travelling, is less than with horse vehicles. The potential travelling capacity of the automobile vehicle for any given period as compared with a horse drawn vehicle is about as five to one. Any one of these several kinds are taking out patents for new forms, improvements and accessories in great numbers in most of the machine manufacturing countries. These new motors seem to be coming into use with a boom as great as that which marked the opening of the bicycle era. Any one of these several kinds will undoubtedly be found more ready and convenient for travelling than a horse, and with a much less cost of maintenance. The frequency of steam cars, electric cars, bicycles and other vehicles of odd form or huge bulk are all so startling as to make extremely dangerous and destroy all pleasure in the use of the horse, so that many persons will as a matter of safety be constrained to adopt the new horseless vehicle. There is no escaping the conviction that the use of the horseless carriage, truck and

delivery wagons is in its infancy. The reduced cost of annual maintenance is estimated to be so great as to make the gain a handsome interest on the investment. In France the autocar seems likely to revive the long vanished glories of the road. They are establishing in France great highway stations where petroleum can be procured and accumulators re-charged; also workshops to supply the necessary mechanism for patching up damaged motors, and restaurant and bedroom accommodations for a limited number of travellers. This will rapidly follow in this country, especially in New Jersey, where so many continuous lines are being so rapidly constructed. The Post Office Department is inviting proposals for carrying mail in large cities by automobiles. Among the automobile owners are men of wealth and influence, and they are proving to be the strongest allies of the wheelmen and farmers in the fight for good roads. All makers of good roads should hail with delight the reign of the automobile, in order to save the wear and tear from the picking and impact of the horses' feet and the rutting and cutting that follows from metal-tired wheels.

AUTOMOBILE PAPERS.

Austria has one automobile paper, Belgium two, France twelve, Germany two, Great Britain three and the United States eight.

GOVERNOR MOUNT'S VIEWS.

Hon. James A. Mount, Governor of Indiana, at the Carriage Builders' Convention at Indianapolis, gave voice of such appropriate sentiments that we print extracts from the speech as it appeared in "The Hub."

"You represent, gentlemen, one of the great industries of our land. The products of your industry, annually, doubtless represent very large sums of money, and your wares find a place in every town and village, and on almost every farm in the United States. In fact, the farmer who does not provide a carriage for his family is a back number. I remember the first criticism that

was passed upon my judgment, when I began, after the close of the war, to carve out my fortune, whichever it may be. I had a lease on a farm, with stock and implements also leased to me. I did not have money enough to buy a team or an implement. The first things for which I incurred a debt were a fine buggy and harness. I was about to marry a young lady who had agreed to unite her fortunes with mine. She had just graduated from school, and had never lived in the country. So the old farmers said: 'Well, well, this fellow marrying a town girl, and the first thing he goes in debt for is a buggy and harness; he'll learn a lesson bye and bye!'

"Well, I don't know whether I wouldn't pass the same criticism again. I believed one thing was necessary to remove some of the objections of rural life, and that was that a farmer should have a convenient and comfortable way of travelling. So I determined to have a good buggy, and what seemed to some men to be a bad investment was really a good one. I was also determined, by hard work, early and late, to teach these men that to give a fair price for a good thing was sound economy. And so, as I remember, I worked early and late, because it was necessary, sometimes even till ten and eleven o'clock at night in the fall of the year, cutting and husking corn, clearing land, ditching, or at whatever came to hand. From the day that I first incurred a debt of \$400 for a buggy and harness, I have never been without a good carriage, buggy or surrey, or some means of conveyance on my farm. Such a thing is a necessity.

"In the next place, as soon as I was able to secure land and pay for a farm, which I did at the end of fifteen years, I began my struggle for another good thing for the country—the creation of good roads. I donated more money for improved highways than any man in my county. I have spent many a night, after the day's work was done, when we were building roads, riding over the country and encouraging farmers to make a donation for road improvement. That is about the only thing I would donate money for, and since I have had an experience as Governor, and learned something about begging, I don't believe I can beg any harder than I did then. If there is anything

that is worth a man's energy and money, it is good thoroughfares and good conveyances. I can imagine no condition more galling, more discouraging, than that of the man who lives with his family in the thralldom of mud six months in the year. He lacks public spirit and enterprise; he lacks a knowledge of the first principles of sound economics who willingly endures such conditions. The man who thus lives and sees his family in a wagon plodding their weary way through the mud is a subject to be pitied. The man with such environments will think slowly, he will move slowly, and become an all-around, non-progressive man. Man is a creature of environment. The man who lives surrounded with good highways, who sees a good turn-out going by, driving rapidly, with handsomely dressed people in that conveyance, will think more quickly, will step more quickly, has more pride, and is apt to catch inspiration and become more active and progressive.

"I have all my life advocated good conveyances and good thoroughfares on which to use them."

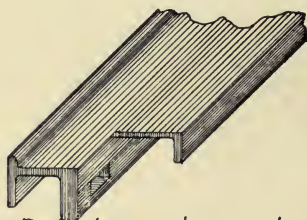
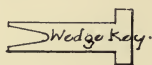
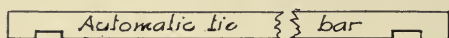
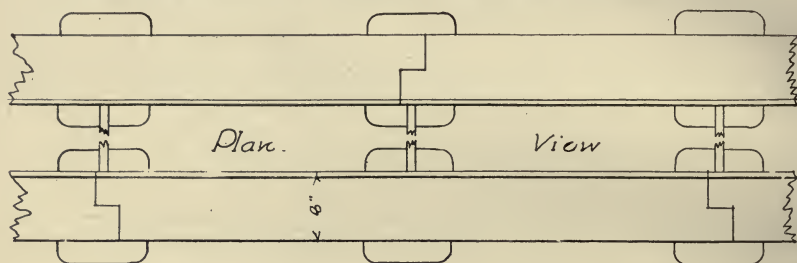
STEEL RAILS FOR COUNTRY ROADS.

As there seems to be on the part of many a desire to see steel rails on our wagon ways, where heavy drafting is the rule, we give room each year for illustrations and descriptions of one of the several patents that are being offered to the public.

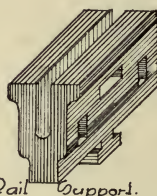
Below will be found an illustration and detailed statement of the cost of a device that has been recently planned by Thomas H. Gibbon, C. E.

For the benefit of the public, we gladly give space to this in our report, leaving the public to judge of its merits. It certainly possesses very desirable qualities, which we hope that experience will demonstrate to be practical.

METAL TRACK FOR WAGONS AUTOMOBILES AND BICYCLES

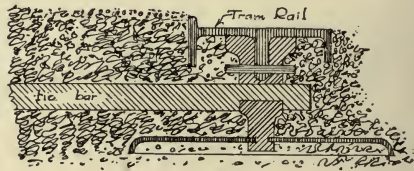
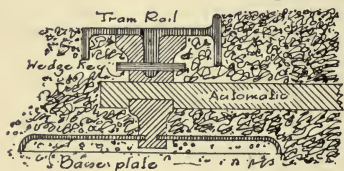


Tram Rail showing lap joint



Rail Support.

Cross Section.



W. H. Gibson & Co.
Inventor.

For further information, apply to
1311-14. Stephen Grand Building
Philadelphia Pa.

STEEL TRACK ROADS.

Estimate of weight of metal and number of parts used in one mile of highway metal track, for use of wagons, automobiles and bicycles.

In strong gravel or broken stone material, the concave base plates and tie bars can be placed 8 feet apart, C to C.

330	Rails, 32 feet long, 8 inches wide face measure.	
1320	Rolled Steel concave base plates 12 x 15 inches x 1 inch deep.	
1320	Uprights on base plates.	
660	Automatic gauge bars.	
1650	Wedge keys.	
5280	Total number of pieces in ONE MILE of track.	
	Estimated cost of digging trenches and laying track as per accompanying instructions	\$300 00
	Estimated weight of metal per lineal yard of track.....	100 lbs.
	Estimated quantity of broken stone or rough gravel for filling trenches for one mile of track.....	300 cu. yds.
	Estimated weight of metal used in ONE MILE of track.....	.75 gross tons.

HOW TO LAY METALLIC HIGHWAY TRACK.

First—Dig longitudinal trenches about 7 inches deep and 15 inches wide.

Second—Place upright on concave base plate.

Third—Place base plates in trenches 8 feet apart, C to C.

Fourth—Pass tie rods through mortises in the upright; this operation will gauge the track.

Fifth—Place wood templet of the girder of the rail in the grooves of the upright. This operation will line the track.

Sixth—Fill trenches with coarse gravel or small broken stones, and roll solid.

Seventh—Remove templet and put the center web of the rail in the impress made by the templet.

Eighth—Drive wedge keys through mortises in rail and upright. This operation locks all the parts together.

Ninth—Dress up, and you will have a track permanent and smooth in character, and ever true to alignment, gauge and grade.

STEEL ROADWAY IN SPAIN.

The road between Valencia and Grao is two miles in length, and an average of 3,200 vehicles pass over it daily. Until 1892 it was constructed of flint stone. The annual cost of keeping it in repair was about \$5,470. The construction of a steel roadway was determined on, and the annual cost of keeping in repair the central belt of road thus relieved from heavy traffic—which proceeds over the steel rails—is now about \$380. The total cost of the road laid was \$9,506. The expense in detail was: Steel, \$6,890; transportation and laying steel, \$507; binding-stone construction, \$2,109—total, \$9,506. The rails, during the seven years they have been in position, have not required repairing. At each side of the rail are layers of binding stones, the paved road being higher than the face of the rails. A toll of (about) eight-tenths of a cent is charged each vehicle passing over this roadway.—*The Railroad Gazette*, Nov. 24th, 1899.

GRAVEL PITS IN NEW JERSEY USED FOR ROAD-BUILDING.

Atlantic, Cumberland, Cape May, Camden, Gloucester and Ocean counties have numerous rich, ferruginous deposits of gravel, which are largely used in improving their local roads. They answer a very good purpose when the beds to be covered are sandy, and when the traffic is not heavy.

BURLINGTON COUNTY.

Pits.	Owners.	P. O. Address.
Riverton gravel	Lewis Connor	Riverton, N. J.
Westfield gravel	Enoch Evans	Westfield, N. J.
Lippincott gravel	Wm. R. Lippincott's estate....	Westfield, N. J.
Evaul gravel	Isaac Evaul	Palmyra, N. J.
Morgan gravel	Wm. F. Morgan	Palmyra, N. J.
Hunter gravel	Franklin T. Hunter	Riverton, N. J.
Brock gravel	Edwin M. Brock	Bridgeboro, N. J.
Collins gravel	John S. Collins	Moorestown, N. J.
Warrick gravel	John Warrick	Hartford, N. J.
Stokes gravel	James W. Stokes	Rancocas, N. J.

Pits.	Owners.	P. O. Address.
Bunting gravel	Thomas A. Bunting.....	Columbus, N. J.
Rogers gravel	Thomas H. Rogers.....	Columbus, N. J.
Kinsley gravel	C. G. Kinsley.....	Kinkora, N. J.
Wilson gravel	Edward Wilson.....	Columbus, N. J.
Sharp gravel	Charles Sharp.....	Columbus, N. J.
Bowne gravel	George Bowne.....	Florence, N. J.
Garnee gravel	Garnee estate.....	Jacksonville, N. J.
Hutchinson gravel	John B. Hutchinson.....	Georgetown, N. J.
Black gravel	Charles Black.....	Jobstown, N. J.
Austin gravel	Allen Austin.....	Centerton, N. J.
Buzby gravel	Mrs. John Buzby.....	Willingboro, N. J.
Coomb gravel	J. H. Coomb.....	Beverly, N. J.
Johnson gravel	Samuel Johnson.....	Burlington, N. J.
Baggs gravel	William Baggs.....	Beverly, N. J.
Fenimore gravel	Joshua Fenimore.....	Beverly, N. J.

MIDDLESEX COUNTY.

Pits.	Owners.	P. O. Address.
Herbert's	I. Biddle Herbert.....	Old Bridge, N. J.
Helmetta	Geo. W. Helme.....	Helmetta, N. J.
Jamesburg	James Buckelew's Sons.....	Jamesburg, N. J.
Englishtown	Chas. Hoffman.....	Englishtown, N. J.

Trap outcrops to a small extent in Middlesex county.

MONMOUTH COUNTY.

Pits.	Owners.	P. O. Address.
Shark River gravel.....	S. B. Oviatt.....	Asbury Park, N. J.
Allenwood gravel.....	George Potts.....	Ocean Grove, N. J.
Swan gravel	Webster Swan.....	Navesink, N. J.
Crawford gravel.....		Holmdel, N. J.
Keyport Gravel.....		Keyport, N. J.
Red Bank gravel.....		Red Bank, N. J.

Pits in Middletown Township, Monmouth County.

Dr. R. G. Andrew.....	Gravel pit.
Walter Swan	"
Peter Conover	"
John T. Hopping.....	"
Garrett Luyster	"
Henry Field	"
James Hubbard	"
George K. Hopping.....	"
John West	"
John Evans	"
John T. Applegate	"

OCEAN COUNTY.

Pits.	Owners.	P. O. Address.
Lakewood gravel	Wm. Harrison.....	Lakewood, N. J.
Sherman gravel	John Sherman.....	Lakewood, N. J.
Staffordville gravel	Staffordville Gravel Co.....	Staffordville, N. J.

Berkeley, Manchester, Plumstead, Jackson, Ocean, Union, Eagleswood and Little Egg Harbor townships all have good gravel.

QUARRIES IN NEW JERSEY PRODUCING ROAD METAL.

Bergen and Hunterdon counties have numerous quarries, the names of which we have not succeeded in obtaining.

ESSEX COUNTY.

Owners.	Location.	Address.
Osborne & Marcellis.....	Montclair, N. J.....	Montclair, N. J.
F. J. Marley.....	Montclair, N. J.....	Little Falls, N. J.
Wright & Lindsley.....	Orange, N. J.....	Orange, N. J.
George Spottiswoode & Co....	Orange, N. J.....	Orange, N. J.
C. A. Lighthipe & Son.....	Millburn, N. J.....	Millburn, N. J.

HUDSON COUNTY.

Quarry.	Owners.	P. O. Address.
Bergen Hill	B. M. & J. F. Shanley.....	Newark, N. J.
Palisade Construction Co.....	}	1 Montgomery St., Jersey City, N. J.
Hudson County Contracting Co.....		367 Communipaw Ave., Jersey City, N. J.

HUNTERDON COUNTY.

Quarry.	Owners.	P. O. Address.
Berger's	M. F. Berger.....	Byram Station, N. J.
Shanley's	B. M. & J. F. Shanley....	Byram Station, N. J.

MERCER COUNTY.

Quarry.	Owners.	P. O. Address.
Moore's	Del. River Q. & Cons. Co..	Lambertville, N. J.
Lambertville	Barbour & Ireland.....	1241 Filbert St., Phila.
Goat Hill	B. M. & J. F. Shanley..	14 S. Broad St., Phila.
Hopewell	Hopewell Quarry Co.....	Hopewell, N. J.
Titusville	Trenton Stone & Cons. Co....	Trenton, N. J.



Rocky Hill Stone and Storage Company's Trap Rock Quarry.



Rocky Hill Quarry Crusher,
At Rocky Hill, N. J.

MORRIS COUNTY.

Nearly all road-building material in this county is of native rock, gneiss, granite and shale. The traps are mostly imported from other counties.

PASSAIC COUNTY.

Location.	Owners.	P. O. Address.
Cedar Grove	Francisco Bros.....	Cedar Grove, N. J.
Cedar Grove	Francis Marley.....	Little Falls, N. J.
Paterson	Berger & Wolf.....	Paterson, N. J.
Paterson	E. T. Galloway.....	Paterson, N. J.
Paterson	McKiernan & Bergen.....	Paterson, N. J.
Notch Road	Francis Marley.....	Little Falls, N. J.
Notch Road	Edward Dowling.....	Notch Road, N. J.
Haledon	R. M. Torbet.....	Haledon, N. J.
Hawthorne	Daniel & D. Stanley.....	Hawthorne, N. J.
Preakness	Colfax & Steele.....	Preakness, N. J.
Paterson	Munson & Co.....	Rockaway, N. J.

SOMERSET COUNTY.

Quarry.	Owners.	P. O. Address.
Wilson's	James Wilson.....	Dunellen, N. J.
Smalley's	A. I. & N. B. Smalley..	North Plainfield, N. J.
Morris County Crushed Stone Co., Millington	Fred. W. Schmidt.....	Morristown, N. J.
Chimney Rock	William Haelig.....	Bound Brook, N. J.
Hillpot's	J. E. Hillpot.....	Bound Brook, N. J.
Hardgrove's	William Hardgrove.....	Somerville, N. J.
Rocky Hill Stone Storage Co..	Fred. De Coppet, Supt.....	Rocky Hill, N. J.
Bernardsville	Frank S. Tainter.....	Morristown, N. J.
Schley's (private)	Grand Schley.....	Far Hills, N. J.
Mine Brook Stone Co.....	McCollum & Freeman....	Bernardsville, N. J.

SUSSEX COUNTY.

Quarry.	Owners.	P. O. Address.
Newton State Quarry.....	David B. Hetzel, Attorney.....	Newton, N. J.

UNION COUNTY.

Quarry.	Owners.	P. O. Address.
Wilson.....	Howard S. Wilson.....	Plainfield, N. J.

Extensive bodies of trap in Union county, but few quarries. Have been able to secure the name and locality of but one.



Barber & Ireland's Trap Rock Quarry,
Near Lambertville, Mercer county.



Delaware River Quarry and Construction Company's Stone
Crushing Plant,
At Moore's Station, near Lambertville, Mercer county.

STATEMENTS BY ENGINEERS AND SUPERVISORS.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find detailed statement of the cost of Chestnut Neck road, county of Atlantic, State of New Jersey. Total length, 3,997.5 feet. Total length, 8-11 miles.

Width of gravel-bed, 14, 16 and 22 feet.

Length of gravel-bed, 3,997.5 feet.

Depth of gravel-bed, 8 inches in centre, 6 inches on edges, compact.

Preparation of road-bed (cost).....	\$185 00
2100 loads of gravel at 5 cents; total.....	105 00
Gravel, 750.49 cubic yards, at 40 cents; total.....	300 20
Gravel, 659.38 cubic yards, at 32 cents; total.....	211 00
Wooden tide, break and fender, 5500 lineal ft. @ 11 cents.....	605 00
Stripping gravel bed, 200 cubic yards, at 20 cents.....	40 00
Open ditches, 1125 cubic yards, at 20 cents.....	225 00
Supervisor's Salary	100 00
Engineering expenses	75 19
Total	\$1,846 39

Maximum grade before.....	1.80 per cent.
Maximum grade now.....	.95 per cent.

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement was 8 and 6 inches.

Respectfully yours,

J. J. ALBERTSON,
Engineer.
JAMES B. JOHNSON
Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find a detailed statement of the cost of Longport Drive road, township of Egg Harbor, county of Atlantic, State of New Jersey. Total length, 17,250 feet. Total length, 3 1-11 miles.

Width of stone-bed, 15 feet.

Length of stone-bed, 17,250 feet.

Depth of stone-bed, 4 inches on 4 inch gravel foundation.

Number of tons of stone used in construction, 5,265.

3900 cubic yards crushed stone, at \$1.75; total.....	\$6,825 00
1211 cars gravel, at \$6.00; total.....	7,266 00
Earth excavation, 13,480 cubic yards, at 19 cents.....	2,561 20
Earth excavation and carting, 3000 cubic yards, at 30 cents.....	900 00
Carting, spreading and rolling stone.....	1,950 00
Carting, spreading and rolling gravel.....	1,717 00
Supervisor's salary	600 00
Engineering expenses	799 57
Total	\$22,618 77

Maximum grade before. No road; abrupt sand banks.

Maximum grade now..... 0.24 per cent.

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement was 4 inches.

Respectfully yours,

J. J. ALBERTSON,

Engineer.

W. H. BURGESS,

Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of the Burlington and Mt. Holly road, Burlington city, townships of Burlington and Westhampton, county of Burlington, State of New Jersey. Total length, 27,711 feet. Total length, 5¼ miles.

Width of stone-bed, 14 feet.

Length of stone-bed, 27,711 feet.

Depth of stone-bed, 6 inches.

Cost of road, lump bid.....	\$18,500 00
Macadam, 43,106 square yards, at.....cents; total.....	0
Tile drain, 5,000 lineal feet, at.....cents.....	494 00
Supervisor's salary	370 00
Engineering expenses	
Total	\$19,364 00

Maximum grade before..... 3½ per cent.

Maximum grade now..... 3½ per cent.

We hereby certify the above statement to be correct, and that the pave-



Burlington and Mt. Holly Road,
Burlington county. Before. Sand and clay bottom.



Burlington and Mt. Holly Road,
Burlington county. After. 6-inch macadam, 14 feet wide.

ment was constructed strictly according to the specifications, and that the depth of finished pavement was 6 inches.

Within city limits of Burlington, the road was made two feet wider and two inches deeper than the above. Length, 4,266 feet.

Respectfully yours,

HENRY S. HAINES,
Engineer.
JOHN B. DAVIS,
Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of the Mullica River road, township of Bass River, county of Burlington, State of New Jersey. Total length, 8451 feet. Total length, 1 $\frac{3}{4}$ miles.

Width of gravel-bed 15 feet.

Width of gravel-bed, 15 feet.

Width of oyster-bed, 8 feet.

Depth of gravel-bed, 6 inches.

Depth of oyster-bed, 6 inches.

Oyster shell, 32,069 bushels, at 9 cents.....	\$2,886 21
Gravel, 4839 cubic yards, at 45 cents; total.....	2,177 55
Supervisor's salary	273 00
Engineering expenses	110 45
Total	<u>\$5,447 21</u>

Maximum grade before..... none.
Maximum grade now..... "

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement was 6 inches.

Respectfully yours,

JOHN W. HARRIS,
Engineer.
JOSEPH B. LAMSON,
Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.

DEAR SIR—Below find an exact detailed statement of the cost of Farnsworth avenue and Park street, township of Bordentown, county of Burlington, State of New Jersey. Total length, 8484 feet. Total length, 1 3-5 miles.

Width of stone-bed, 16 feet.

Length of stone-bed, 8484 feet.

Depth of stone-bed, 8 inches.

Macadam, 15,113.3 square yards, at 52 cents; total.....	\$7,858 92
Earth excavation, 3374 cubic yards.....	
Supervisor's salary	417 00
Engineering expenses	157 18
Total	<u>\$8,433 10</u>

Maximum grade before.....	8.7 per cent.
Maximum grade now.....	7 per cent.

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement was 8 inches.

Respectfully yours,

EDGAR HAAS, JR.,
Engineer.
SAMUEL S. TAYLOR,
Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of the Trenton road, township of Bordentown, county of Burlington, State of New Jersey. Total length, 9,391 feet. Total length, 14.5 miles.

Width of stone-bed, 12 feet.
Length of stone-bed, 9,391 feet.
Depth of stone-bed, 8 inches.

Macadam, 12,721 square yards, at 49 cents.....	} Contract, lump sum \$7,399 00	
Earth excavations, 5,103 cubic yards, at 18 cents.....		
Tile drain, 4,000 lineal feet, at 8 cents.....		
Supervisor's salary		564 00
Engineering expenses		161 10
Total		<u>\$8,124 10</u>

Maximum grade before.....	7.0 per cent.
Maximum grade now.....	4.8 per cent.

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement was 8 inches.

Respectfully yours,

EDGAR HAAS,
Engineer.
SAMUEL S. TAYLOR,
Supervisor.

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Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of the Georgetown road, townships of Bordentown and Chesterfield, county of Burlington, State of New Jersey. Total length, 6,308 feet. Total length, 1 1-5 miles.

Width of stone-bed, 10 feet.
Depth of stone-bed, 6 inches.
Length of stone-bed, 6,308 feet.

Macadam, 7,115 5-13 square yards, at 52 cents; total contract.....	\$3,700 00
142 square yards of Y's extra, 52 cents.....	73 84
Tile drain, 250 lineal feet, at 0 cents.....	
Supervisor's salary	180 00
Engineering expenses	79 07
Total	<u>\$4,032 91</u>

Maximum grade before.....	3.4 per cent.
Maximum grade now.....	2.9 per cent.

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement was 6 inches.

Respectfully yours,

PETER E. HARVEY,
Engineer.
EDWIN H. WEST,
Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of the Cross Roads and Ballenger's mill road, township of Medford, county of Burlington, State of New Jersey. Total length, 20,025 feet. Total length, 3 6-7 miles.

Width of stone-bed, 10 and 16 feet.
Length of stone-bed, 20,025 feet.
Depth of stone-bed, 6 inches.

Macadam, 23,950 square yards.....	} Lump sum, \$12,198 00
Tile drain, 4,195 lineal feet, at..... cents.....	
Supervisor's Salary	300 00
Engineering expenses	243 96
Total	<u>\$12,741 96</u>

Maximum grade before.....	4.50 per cent.
Maximum grade now.....	3.20 per cent.

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement was 6 inches.

Respectfully yours,

JAMES LIPPINCOTT,
JOHN W. HARRIS,
Engineers.
JAPHET BOWKER,
Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of the Columbus and Bowne's corner road, township of Mansfield, county of Burlington, State of New Jersey. Total length, 16,590 feet. Total length, 3 miles.

Width of stone-bed, 10 feet.

Depth of stone-bed, 6 inches.

Length of stone-bed, 16,975 feet.

Macadam, 19,135 2-3 square yards, at 52 cents; total.....	\$9,950 55
Y's, 433 1-3 square yards, at 52 cents; total.....	225 33
Tile drain, 2,982 lineal feet, at 10 cents.....	298 20
Supervisor's salary	348 00
Engineering expenses	209 48
Total	\$11,031 56

Maximum grade before.....	7 per cent.
Maximum grade now.....	4½ per cent.

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement was 6 inches.

Respectfully yours,

PETER E. HARVEY,
Engineer.
ISRAEL KERLIN,
Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of Park avenue, township of Pensauken and borough of Merchantville, county of Camden, State of New Jersey. Total length, 10,600.9 feet. Total length, 2 1-50 miles.

Width of stone-bed, 14 feet.

Length of stone-bed, 10,536.9 feet.

Depth of stone-bed, 8 inches.

COMMISSIONER OF PUBLIC ROADS.

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Macadam, 16,390.7 square yards, at 77 cents; total.....	\$12,620 84
Earth excavation, 1,200 cubic yards, at 25 cents.....	300 00
Tile drain, 1,219 lineal feet, at 9 cents.....	109 71
Supervisor's salary	420 00
Engineering expenses	400 00

Total\$13,850 55

Maximum grade before.....	4.6 per cent.
Maximum grade now.....	3.7 per cent.

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement is 8 inches.

Respectfully yours,

J. J. ALBERTSON,
County Engineer.
JOHN W. COX,
Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find detailed statement of the cost of Massey avenue, township of Haddon, county of Camden, State of New Jersey. Total length, 1,089 feet. Total length, 5-24 miles.

Width of stone-bed, 12 feet.

Length of stone-bed, 1,089 feet.

Depth of stone-bed, 6 and 10 inches.

Macadam, 506 square yards	} Lump sum.....	\$1,221 00
Telford, 968 square yards		
Drain pipe		65 00
Supervisor's salary		100 00
Total		\$1,386 00

Maximum grade before.....	1 per cent.
Maximum grade now.....	1 per cent.

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement was 6 and 10 inches.

Respectfully yours,

J. J. ALBERTSON,
Engineer.
WILLIAM C. WOOD,
Supervisor.

SIXTH ANNUAL REPORT

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of the Mount Hebron Road, township of Bloomfield and town of Montclair, county of Essex, State of New Jersey. Total length, 5,588 feet. Total length, 1 mile.

Width of stone-bed, 16 feet.

Length of stone-bed, 5,553.74 feet.

Depth of stone-bed, 8 inches.

Cobble gutter, 488 88-100 square yards, at 72 cents; total.....	\$ 351 99
Telford, 10,156 square yards, at 38 cents; total.....	3,859 28
Earth excavation, 9,017 cubic yards, at 22 cents.....	1,983 74
Total	\$6,195 01

Maximum grade before..... 14 13-100 per cent.

Maximum grade now..... 7 92-100 per cent.

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement was 8 inches.

Respectfully yours,

JAMES OWEN,

Engineer.

HENRY SPEER,

Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of Bay avenue, township of Bloomfield and borough of Glenridge, county of Essex, State of New Jersey. Total length, 2,809 feet. Total length, 6.11 miles.

Width of stone-bed, 16 feet.

Length of stone-bed, 2,801 feet.

Depth of stone-bed, 8 inches.

Cobble gutter, 1,163 50-100 square yards, at 72 cents; total.....	\$ 837 72
Telford, 4,994 square yards, at 39½ cents; total.....	1,972 63
Earth excavation, 7,924 cubic yards, at 20 cents.....	1,584 80
Total	\$4,395 15

Maximum grade before..... 9 25-100 per cent.

Maximum grade now..... 7 10-100 per cent.

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement was 8 inches.

Respectfully yours,

JAMES OWEN,

Engineer.

HARRY COOPER,

Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of Broad street, township of Bloomfield, county of Essex, State of New Jersey. Total length, 14,892 feet. Total length, $2\frac{7}{8}$ miles.

Width of stone-bed, 16 feet.

Length of stone-bed, 14,892 feet.

Depth of stone-bed, 10 inches.

Telford, 26,476 2-10 square yards, at 41 cents; total.....	\$10,855 24
Earth excavation, 21,447 cubic yards, at 23 cents.....	4,932 81
Total	<u>\$15,788 05</u>

Maximum grade before.....	4 77-100 per cent.
Maximum grade now.....	3 92-100 per cent.

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement was 10 inches.

Respectfully yours,

JAMES OWEN,
Engineer.
JOHN GARRABRANT,
Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of Franklin avenue, township of Bloomfield, county of Essex, State of New Jersey. Total length, 3,263 feet. Total length, 3-5 mile.

Width of stone-bed, 16 feet.

Depth of stone-bed, 8 inches.

Length of stone-bed, 3,263 feet.

Telford, 5,894 square yards, at 49 cents; total.....	\$2,888 06
Earth excavation, 8,495 cubic yards, at 20 cents.....	1,699 00
Total	<u>\$4,587 06</u>

Maximum grade before.....	13.8 ft. in. 100
Maximum grade now.....	5.2 ft. in. 100

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement was 8 inches.

Respectfully yours,

JAMES OWEN,
Engineer.
JACOB TROUTFETTER,
Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of Watchung avenue, township of Bloomfield, borough of Glenridge and town of Montclair, county of Essex, State of New Jersey. Total length, 7,440 feet. Total length, 1½ miles.

Width of stone-bed, 16 feet.

Length of stone-bed, 7,389 feet.

Depth of stone-bed, 8 inches.

Cobble gutter, 4,356 square yards, at 72 cents; total.....	\$3,136 32
Telford, 13,233 square yards, at 40½ cents; total.....	5,359 36
Earth excavation, 8,690 cubic yards, at 22 cents.....	1,911 80
Total	\$10,407 48

Maximum grade before.....	12 25-100 per cent.
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Maximum grade now.....	12 16-100 per cent.
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We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement was 8 inches.

Respectfully yours,

JAMES OWEN,

Engineer.

ROBERT DOW,

Supervisor for Montclair Section.

HARRY COOPER,

Supervisor for Bloomfield and Glen Ridge Section.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of Bloomfield avenue, township of Caldwell, county of Essex, State of New Jersey. Total length, 8,311 feet. Total length, 1½ miles.

Width of stone-bed, 16 feet.

Length of stone-bed, 8,311 feet.

Depth of stone-bed, 8 inches.

Telford, 14,776 square yards, at 43 cents; total.....	\$6,353 68
Earth excavation, 7,824 cubic yards, at 29 cents.....	2,268 96
Total	\$8,622 64

Maximum grade before.....	6 78-100 per cent.
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Maximum grade now.....	6 48-100 per cent.
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We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement was 8 inches.

Respectfully yours,

JAMES OWEN,

Engineer.

JAMES SPEER,

Supervisor.



Finished Bed, Watchung Avenue,
Essex county, boulder, telford bottom 5 inches, macadam surface 3 inches,



Grove Avenue,
Essex county, 8-inch boulder, telford and macadam. After.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of the Fair-field road, township of Caldwell, county of Essex, State of New Jersey. Total length, 21,356 feet. Total length, 4 miles.

Width of stone-bed, 16 feet.

Length of stone-bed, 21,356 feet.

Depth of stone-bed, 8 inches.

Telford, 38,130 square yards, at 44 cents; total.....	\$16,777 20
Earth excavation, 11,074 cubic yards, at 29 cents.....	3,211 46
Total	<u>\$19,988 66</u>

Maximum grade before	3 28-100 per cent.
Maximum grade now.....	2 42-100 per cent.

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement was 8 inches.

Respectfully yours,

JAMES OWEN,
Engineer.

AARON E. STAGG,
Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of the Franklinville road, township of Franklin, county of Gloucester, State of New Jersey. Total length, 31,530 feet. Total length, 6 miles.

Width of gravel-bed, 14 feet.

Length of gravel-bed, 31,530 feet.

Depth of compact gravel-bed, 6 inches on edge, 8 inches in centre.

Total cost of gravel purchased in the bank.....	\$ 526 85
Committee expenses	21 25
Preparation of road-bed (cost).....	2,007 69
Compact gravel, 66 cubic yards, at intersections, at 34 cents; total....	22 44
Compact gravel, 16 cubic yards, at intersections, at 54 cents; total...	8 64
Compact gravel, 9,373.5 cubic yards, at 34 cents; total.....	3,186 99
Earth excavation, 2,555 cubic yards, at 20 cents.....	511 00
Stripping, 3,487 1-3 cubic yards, at 20 cents.....	697 46
Overhauls, 4,565.19 cubic yards, at 20 cents.....	913 03
Overhauls, 695.68 cubic yards, at 40 cents.....	278 27
Open drain, 237 2-9 cubic yards, at 15 cents.....	35 58
Grubbing sidewalks, 2.24 acres, at \$25.00.....	56 00
Supervisor's salary, 132 days, at \$3.00.....	396 00
Engineering expenses	399 96
Total	<u>\$9,061 16</u>

SIXTH ANNUAL REPORT

Maximum grade before.....	4.10 per cent.
Maximum grade now.....	2.20 per cent.

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished road was 6 inches on edge and 8 inches in middle.

Respectfully yours,

J. J. ALBERTSON,

Engineer.

HARRY W. JONES,

Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of Broad street, Woodbury, county of Gloucester, State of New Jersey. Total length, 4,204 feet. Total length, 4-5 mile.

Width of stone-bed, 10 to 15 feet.

Length of stone-bed, 4,204 feet.

Depth of stone-bed, 8 inches.

Macadam, 12,077 square yards, at 50 cents; total.....	\$6,038 50
Earth excavation, 2,950 cubic yards, 20 cents.....	590 00
Tile drain, 800 lineal feet, at 10 cents.....	80 00
	<hr/>
	\$6,708 50
Lump sum, contract price.....	\$6,500 00
Supervisor's salary	189 00
Engineering expenses	130 00
Advertising proposals and printing specifications.....	29 43
Committee expenses	30 00
	<hr/>
Total	\$6,878 43

Maximum grade before.....	4 per cent.
Maximum grade now.....	4 per cent.

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement was 8 inches.

Respectfully yours,

WILLIAM M. CARTER,

Engineer.

SAMUEL H. LADD,

Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find exact detailed statement of cost of road from Hurffville to Cross Keys, township of Washington, county of Gloucester, State of New Jersey. Total length, 28,588 feet. Finished length, 16,000 feet.

Width of gravel-bed, 14 feet.

Finished length of gravel-bed, 16,000 feet.

Depth gravel-bed, 8 inches in centre, 6 inches on sides.

CONSTRUCTION.

Preparation of road-bed, 16,000 feet, at 4 cents.....	\$ 640 00	
Grubbing 1.08 acres, at \$100.00.....	108 00	
Tile drain, 2,050 feet, at 15 cents.....	307 50	
Open ditches, 146 cubic yards, at 20 cents.....	29 20	
Excavation in excess of 12 inches, 740 cubic yards at 22½ cents	166 50	
Compact gravel, 4,840 cubic yards, at 37½ cents.....	1,815 00	
Overhaulage, 4,768 cubic yards, at 15 cents.....	715 20	
Stripping gravel-beds, 2,410 cubic yards, at 20 cents.....	482 00	\$4,263 40

MATERIAL.

Gravel, 4,840 cubic yards, at 8½ cents.....	411 40	
Supervisor's salary	288 00	
Engineering expenses	128 49	
Total	\$5,091 29	

Maximum grade before.....	2 1-10 per cent.
Maximum grade now.....	1 per cent.

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement was 11 4-10 inches in the centre, and 7 1-10 inches on the sides, which was ascertained by plugging at least and not less than every 500 feet and measuring from the surface of the earth foundation to a line stretched across the road from the top of the grade at the crown, and to the finished grade on the sides.

Respectfully yours,

WM. C. CATTELL,

Engineer.

SAMUEL J. EVANS,

Supervisor.

Estimate of amount required to finish road.....	\$4,092 00
Already expended	5,091 29
Estimate of cost of road.....	\$9,183 29

WM. C. CATTELL.

Engineer.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find exact detailed statement of cost of road from Woodbury to Knight's run, townships of Deptford and Mantua, city of Woodbury, county of Gloucester, and State of New Jersey. Total length, 27,768 feet. Finished length, 8,400 feet.

Width of gravel-bed, 14 feet.

Finished length of gravel-bed, 8,400 feet.

Depth of gravel-bed, 10 inches in centre, 6 inches on sides.

CONSTRUCTION.

Preparation of road-bed, 8,400 feet, at 10 cents.....	\$ 840 00	
Grubbing 1.01 acres, at \$50.00.....	50 50	
Excavation in excess of 12 inches, 4,086 yards, at 25 cents,	1,021 50	
Compacted gravel, 2,903 cubic yards, at 47 cents.....	1,364 41	
Overhaulage, 1,408 cubic yards, at 25 cents.....	352 00	
Stripping gravel-beds, 2,228 cubic yards, at 25 cents.....	557 00	\$4,185 41

MATERIAL.

Gravel, 2,903 cubic yards, at 10 cents.....	\$ 290 30	
Supervisor's salary	252 00	
Engineering expenses	124 51	
Total	\$4,852 22	

Maximum grade before..... 5.05 per cent.

Maximum grade now..... 2 $\frac{1}{4}$ per cent.

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement was 11 45-100 inches in the centre, and 7 15-100 inches on the sides, which was ascertained not less than every 500 feet and measuring from the earth foundation to a line on the finished grade.

Respectfully yours,

WM. C. CATTELL,

Engineer.

FRANK T. HENDRICKSON,

Supervisor.

Estimate of amount required to finish road, 8,700 feet of the same being changed from gravel to stone, \$13,000.00.

WM. C. CATTELL,

Engineer.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of the Pennington road, townships of Ewing and Hopewell, county of Mercer, State of New Jersey. Total length, 35,575 feet. Total length, $6\frac{3}{4}$ miles.

Width of stone-bed, 14 feet.

Length of stone-bed, 35,575 feet.

Depth of stone-bed, 6 and 8 inches.

6 inch macadam, 21,737 square yards, at 48 cents; total.....	\$10,433 76
8 inch macadam, 34,023 square yards, at 57 cents; total.....	19,393 11
Earth excavation, 9,175 cubic yards, at 20 cents.....	1,835 00
Tile drain, 48,584 lineal feet, at 10 cents.....	4,858 40
Supervisor's salary	565 50
Engineering expenses	913 00
Total	\$37,998 77

Maximum grade before.....	4.2 per cent.
Maximum grade now.....	3.46 per cent.

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement was 6 and 8 inches.

Respectfully yours,

FRANK J. EPPELE,

Engineer.

FRANKLIN H. BURROUGHS,

Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of the Asylum road, township of Ewing, county of Mercer, State of New Jersey. Total length, 15,432 feet. Total length, about 3 miles.

Width of stone-bed, 14 feet.

Length of stone-bed, 15,432 feet.

Depth of stone-bed, 6 inches.

Macadam, 23,860 square yards, at $37\frac{1}{2}$ cents; total.....	} Lump sum....	10,475 00
Earth excavation, 7,665 cubic yards, at 20 cents		
Tile drain, 1,138 lineal feet, at 12 cents.....		136 56
Supervisor's salary		274 00
Engineering expenses		265 29
Total		\$11,150 85

Maximum grade before.....	6.2 per cent.
Maximum grade now.....	5.35 per cent.

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement was 6 inches.

Respectfully yours,

FRANK J. EPPELE,

Engineer.

JOHN V. GREEN,

Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of Upper Ferry road, township of Ewing, county of Mercer, State of New Jersey. Total length, 6,181.5 feet. Total length, 1 1-6 miles.

Width of stone-bed, 12 feet.

Length of stone-bed, 6,181.5 feet.

Depth of stone-bed, 6 inches.

Macadam, 8,210 square yards, at 36½ cents,	} Lump sum .. \$3,425 00	
Earth excavation, 2,115 cubic yards, at 20 cents,		
Tile drain, 650 lineal feet, at 12 cents.....		78 00
Supervisor's salary		115 50
Engineering expenses		87 58
Total		\$3,706 08

Maximum grade before..... 6 per cent.

Maximum grade now..... 5 per cent.

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement was 6 inches.

Respectfully yours,

FRANK J. EPPELE,

Engineer.

BENJ. C. BALDWIN,

Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of the Old Bridge road, county of Middlesex, State of New Jersey. Total length, 15,840 feet. Total length, 3 miles.

Width of stone-bed, 12 feet.

Depth of stone-bed, 8-12 feet.

Length of stone-bed, 15,840 feet.



Fairfield Road,
Essex county, telford 5-inch, macadam 3-inch, showing boulders being laid for
telford bottom.



Fairfield Road,
Essex county. After. Boulder telford 5-inch, macadam surface 3-inch.

COMMISSIONER OF PUBLIC ROADS.

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Macadam, 21,120 square yards, at 73 cents; total.....	\$15,417 60
Maximum grade before.....	7 per cent.
Maximum grade now.....	5 per cent.

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications.

Respectfully yours,

R. J. DOUGHERTY,
Engineer.
DANIEL DAVISON,
Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of the George's road, township of North Brunswick, county of Middlesex, State of New Jersey. Total length, 24,500 feet, or 4 2-3 miles.

Width of stone-bed, 12 feet.
Length of stone-bed, 24,500 feet.
Depth of stone-bed 8 inches.

Macadam, 32,667 square yards, at cents; total	} Lump sum..	\$17,640 18
Earth excavation, 5,000 cubic yards, at cents		
Tile drain, 435 lineal feet, at 12 cents.....		52 20
Supervisor's salary		441 00
Engineering expenses		353 85
Total		\$18,487 23

Maximum grade before.....	4 per cent.
Maximum grade now.....	3 per cent.

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement was 8 inches.

Respectfully yours,

R. J. DOUGHERTY,
Engineer.
E. D. RIGHTMIRE,
Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of the Cranbury road, township of Cranbury, county of Middlesex, State of New Jersey. Total length, 11,650 feet. Total length, 2 1-5 miles.

Width of stone-bed, 12 feet.
Length of stone-bed, 11,650 feet.
Depth of stone-bed, 8 inches.

Macadam, lump sum, per specifications; total.....	\$7,650 00
Telford, 2,324 square yards, at 26 cents additional; total.....	604 24
Earth excavation, 1,362 cubic yards, at 35 cents.....	476 70
Laying iron pipe, 275 feet.....	75 00
Tile drain, 2,704 lineal feet, at 15 1-3 cents.....	414 61
Supervisor's salary	198 00
Engineering expenses	184 41
Total	<u>\$9,602 96</u>

Maximum grade before.....	4 per cent.
Maximum grade now, except at R. R. bridge.....	1½ per cent.

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement was 8 inches.

Respectfully yours,

R. J. DOUGHERTY,
Engineer.

D. C. Lewis,
Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of the Lower Squankum and Turkey road, township of Howell, county of Monmouth, State of New Jersey. Total length, 23,800 feet. Total length, 4½ miles.

Width of gravel-bed, 14 feet.
Length of gravel-bed, 23,800 feet.
Depth of gravel-bed, 9 inches.

Preparation of road-bed (cost), for 23,800 lineal feet.....	\$ 952 00
Gravel, 9,255 15-27 cubic yards, at 55 cents; total.....	5,090 55
Excavation and fill, 5,153 cubic yards, at 21 cents.....	1,082 13
Overhaulage, per specifications.....	677 87
Rodmen and chainmen.....	48 00
Supervisor's salary	390 00
Engineering expenses	310 00
Total	<u>\$8,550 55</u>

Maximum grade before.....	4.26 per cent.
Maximum grade now.....	2.83 per cent.

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement was 9 inches.

Respectfully yours,

PETER FORMAN,
Engineer.

GEO. W. PATTERSON, JR.,
Supervisor.

COMMISSIONER OF PUBLIC ROADS.

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Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of the Sweetman's lane and Tennant Station road, county of Monmouth, State of New Jersey. Total length, 14,080 feet. Total length, 2 2-3 miles.

Width of stone-bed, 10 feet.
Length of stone-bed, 14,080 feet.
Depth of stone-bed, 6 inches.

Excavation and fill, 6,366 cubic yards, at 20 cents.....	\$1,273 20
Tile drain, 5,335 lineal feet, at 8 cents.....	426 80
Total	<u>\$1,700 00</u>

To be finished next year.

The amount needed to complete the contract is..... 9,979 34

We hereby certify the above statement to be correct.

Respectfully yours,

PETER FORMAN,
Engineer.
TUNIS PROBASCO,
Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of the road from Red Bank to Eatontown, townships of Shrewsbury and Eatontown, county of Monmouth, State of New Jersey. Total length, 15,800 feet. Total length, 3 miles.

Width of stone-bed, 14 and 16 feet.
Length of stone-bed, 15,800 feet.
Depth of stone-bed, 8, 10, 12 and 16 inches.

Number of tons of stone used in construction.....	10,345
Macadam, 20,616 square yards, at 75 cents; total.....	\$15,462 00
Telford, 10 inches, 467 square yards, at 85 cents; total.....	396 95
Telford, 12 inches, 1,778 square yards, at \$1.02 cents; total.....	1,813 56
Telford, 16 inches, 2,022 square yards, at \$1.15 cents; total.....	2,325 30
Extra stone foundations, etc., in bad places.....	495 00
Tile drain, 13,870 lineal feet, at 15 cents.....	2,080 50
Supervisor's salary	234 00
Engineering expenses	678 00
Total	<u>\$23,485 31</u>

Maximum grade before.....	3½ per cent.
Maximum grade now.....	2½ per cent.

We hereby certify the above statement to be correct, and that the pave-

ment was constructed strictly according to the specifications, and that the depth of finished pavement was 8, 10, 12 and 16 inches.

Respectfully yours,

W. H. DENYSE,
Engineer.

SAMUEL SMOCK,
Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of the Nave-sink, First Avenue and Hillside road, township of Middletown, county of Monmouth, State of New Jersey. Total length, 13,270 feet. Total length, 2 513-1,000 miles.

Width of gravel-bed, 14, 16 and 20 feet.

Length of gravel-bed, 13,270 feet.

Depth of gravel-bed, centre 7, side 6 inches.

Contract, lump price	4,150 00
Preparation of road-bed (cost), extra for regrading part of road...	233 20
Gravel(extra 4,412, 267), 4,679 square yards, at 7½ cents; total...	350 92
Supervisor's salary	261 00
Engineering expenses	275 00
Total	\$5,270 12

Maximum grade before..... 8.50-100

Maximum grade now..... 7.10-100

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement was 7 and 6 inches.

Respectfully yours,

FRANK OSBORN,
Engineer.

FRED. D. SICKLES,
Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of Atkin's avenue, township of Neptune, county of Monmouth, State of New Jersey. Total length, 9,327 feet. Total length, about 2 miles.

Width of gravel-bed, 16 feet.

Length of gravel-bed, 9,300 feet.

Depth of gravel-bed, 6 inches.

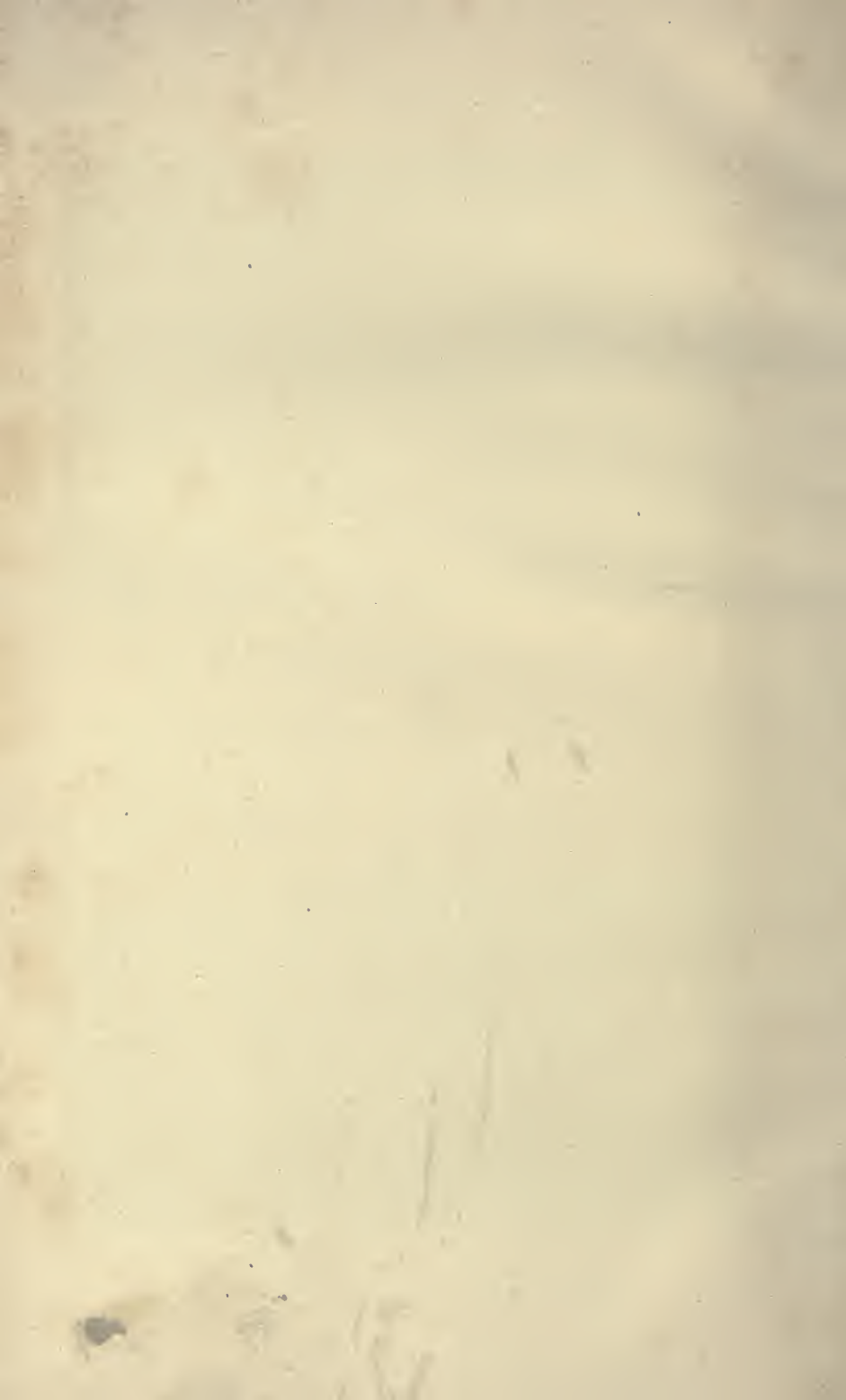
Gravel, square yards, at cents; total—lump.....	\$3,942 00
Supervisor's salary	96 00
Engineering expenses	153 00
Total	\$4,191 00



Atkins Avenue, West Asbury Park,
Monmouth county. Before.



Atkins Avenue, West Asbury Park,
Monmouth county, gravel. After improvement,



Maximum grade before.....	1 per cent.
Maximum grade now.....	1 per cent.

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement was 6 inches.

Respectfully yours,

NIART ROGERS,
Engineer.
R. C. LOVE,
Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of the Denville and Pine Brook road, townships of Rockaway and Hanover, county of Morris, State of New Jersey. Total length, 39,071 feet. Total length, 7 4-10 miles.

Width of stone-bed, 12 feet.

Length of stone-bed, 38,929.5 feet.

Depth of stone-bed, 6 inches.

Macadam, 52,080 square yards, at 41 cents; total.....	\$21,352 80
Earth excavation, 21,328 cubic yards, at 22 cents.....	4,692 16
Rock excavation, 575 cubic yards, at 100 cents.....	575 00
Stone drain, 2,487.6 lineal feet, at 10 cents.....	248 76
Iron drain, 1,192 lineal feet, at \$1.20.....	1,430 40
Supervisor's salary	294 00
Engineering expenses	526 76
Total.....	\$29,119 88

Maximum grade before.....	14 per cent.
Maximum grade now.....	10 per cent.

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement was 6 inches.

Respectfully yours,

WM. E. KING,
Engineer.
STEPHEN H. CONDIT,
Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of the Hanover and Afton road, townships of Chatham and Hanover, county of Morris, State of New Jersey. Total length, 11,360 feet. Total length, 2 1-7 miles.

Width of stone-bed, 12 feet.

Length of stone-bed, 11,313 feet.

Depth of stone-bed, 6 inches.

Macadam, 15,083 square yards, at 45 cents; total.....	\$6,787 35
Gravel, 400 loads, at 10 cents; total.....	40 00
Earth excavation, 4,704 cubic yards, at 25 cents.....	1,176 00
Overhaulage, 300 cubic yards—1,000 feet, at 1 cent.....	30 00
Iron drain, 60 lineal feet, at \$1.10 cents.....	66 00
Supervisor's salary	213 00
Engineering expenses	332 30
Total	<u>\$8,644 65</u>

Maximum grade before.....	7 per cent.
Maximum grade now.....	4 per cent.

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement was 6 inches.

Respectfully yours,

WM. E. KING,
Engineer.
WM. A. HOWELL,
Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of the Rockaway and Hibernia road, borough of Rockaway, county of Morris, State of New Jersey. Total length, 4,800 feet. Total length, 8-9 miles.

Width of stone-bed, 16 and 12 feet.

Length of stone-bed, 4,800 feet.

Depth of stone-bed, 6 inches.

Macadam, 7,502 square yards, at 41½ cents; total.....	\$3,113 33
Earth excavation, 6,387 cubic yards, at 24 cents.....	1,532 88
Rock excavation, 110 cubic yards, at 100 cents.....	110 00
Overhaulage, 1,000 feet, 886 inches, at 10 cents.....	88 60
Tile drain, 1,050 lineal feet, at 72 cents.....	756 00
Iron Pipe, 122.3 lineal feet, at 63 cents.....	77 05
Supervisor's salary	139 50
Engineering expenses	254 78
Total	<u>6,072 14</u>

Maximum grade before.....	8 per cent.
Maximum grade now.....	6.5 per cent.

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement was 6 inches.

Respectfully yours,

WILLIAM E. KING,
Engineer.
JOSEPH H. BROOKS,
Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of the Great Notch road, in Aquacknonk township and Little Falls township, Passaic county, N. J.

9,528 square yards of 4 inch macadam, at 28 cents per cubic yard....	\$2,667 84
4,578 39-100 cubic yd's of earth excavation, at 25 cents per cubic yd.,	1,144 60
1,233½ cubic yards of rock cut, at \$1.50 per cubic yard.....	1,850 25
Pointing up culverts.....	20 00
24 lineal feet of 12 inch cast iron pipe, at \$1.50 per lineal foot.....	36 00
144 lineal feet of 16 inch cast iron pipe, at \$1.90 per lineal foot.....	273 60
45 cubic yards of rubble masonry, at \$4.50 per cubic yard.....	202 50
Total cost	<u>\$6,194 79</u>
Length, 5,271 feet.	

Respectfully yours,
WILLIAM L. WHITMORE,
County Engineer.
THOMAS TAYLOR,
Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—The following will be the cost of the Mountain View and Singal road in Wayne township, Passaic county, N. J.:

8,800 cubic yards of earth excavation, at 25 cents per cubic yard....	\$2,200 00
1,000 cubic yards of rock cut, at 75 cents per cubic yard.....	750 00
18,750 square yards of 4 inch macadam, at 16 cents per square yard..	3,000 00
50 square yards of paved gutters, at 60 cents per square yard.....	30 00
Total	<u>\$5,980 00</u>

Respectfully yours,
WILLIAM L. WHITMORE,
County Engineer.
THOMAS TAYLOR,
Supervisor.

Paterson, N. J., Nov. 23, 1899.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of the Main road through Midvale, Pompton township, Passaic county, N. J.:

42,486 square yards 4 inch macadam, at 20½ cents per square yard..	\$8,709 63
15,876 cubic yards earth excavation, at 15 cents per cubic yard.....	2,381 40
185 cubic yards rock cut, at 50 cents per cubic yard.....	92 50
1,050 square yards bottom stone, at 18½ cents per square yard.....	194 25
Total	<u>\$11,377 78</u>
Supervisor's salary	549 00

\$11,926 78

Total length of road, 23,625 feet.

We hereby certify the above statement to be correct, and that the pavement was constructed strictly in accordance with the specifications.

Respectfully yours,

WILLIAM L. WHITMORE,
Engineer.

W. H. CISCO,
Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—The cost of the Milton road is as follows:

Quantities are as follows:

12,650 square yards of 4 inch macadam, at 20 cents per square yard..	2,530 00
3,000 square yards of 6 inch macadam, at 27 cents per square yard..	810 00
15,000 cubic yards of earth excavation, at 18 cents per cubic yard....	2,700 00
3,500 cubic yards of solid rock, at 60 cents per square yard.....	2,100 00
150 lineal feet of 18 inch cast-iron pipe, at 90 cents per lineal foot....	135 00
50 cubic yards of rubble masonry, at \$1.25 per cubic yard.....	62 50
110 cubic yards of dry wall, at \$2.50 per cubic yard.....	275 00
34 lineal feet of 8 inch vitrified pipe, at 50 cents per lineal foot.....	17 00
1,000 square yards of paved gutters, at 30 cents per square yard....	300 00
50 lineal feet of 18 inch cement pipe, at \$1.10 per lineal foot.....	55 00
Total	\$8,984 50

Respectfully yours,

WILLIAM L. WHITMORE,
County Engineer.

E. Y. COURSEN,
Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of the Hancock Bridge road, township of Lower Alloways Creek, county of Salem, State of New Jersey. Total length, 11,450 feet. Total length, 2 17-100 miles.

Width of shell-bed, 10 feet.

Length of shell-bed, 11,450 feet.

Depth of shell-bed, 12 inches.

Number of bushels of shells used in construction, about.....	105,000
Cost of shells, at 2½ cents per bushel.....	\$2,625 00
Contract price for building road, other than furnishing shells } ...	2,204 76
12,722 22-100 square yards, at \$17.33 cents; total	
Other expenses	100 00
Supervisor's salary	150 00
Engineering expenses	100 00
Total	\$5,179 76

Maximum grade 3-10 per cent.

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement was 12 inches.

Respectfully yours,

JOSIAH MILLER,

Engineer.

J. WARREN SMITH,

Supervisor.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—Below find an exact detailed statement of the cost of the Mine Brook road, township of Bernards, county of Somerset, State of New Jersey. Total length, 34,973 feet. Total length, 6 3-5 miles.

Width of stone-bed, 12 feet.

Length of stone-bed, 34,973 feet.

Depth of stone-bed, 10 inches.

Number of tons of stone used in construction, approximate.....	14,044
Preparation of road-bed (cost), included in cost of stone.....	\$
Telford, 47,000 square yards, at 56½ cents; total.....	26,555 00
Earth excavation, 15,230 cubic yards.....	
Rock excavation, 2,175 cubic yards, at 100 cents.....	2,175 00
Ditching, 34,500 feet, at 1½ cents.....	517 50
Tile drain, 5,000 lineal feet, at 12 cents.....	600 00
Supervisor's salary	414 00
Engineering expenses	1,618 47
Total	\$31,879 97

EXTRAS.

Regrading hill	\$ 40 00
Extra screenings	50 00
Extra stone	169 50
Belgian block	45 00
Cobble ditch	10 00
	<hr/>
	314 50
	<hr/>
	\$32,194 47

Maximum grade before.....	12.8 per cent.
Maximum grade now.....	8.14 per cent.

We hereby certify the above statement to be correct, and that the pavement was constructed strictly according to the specifications, and that the depth of finished pavement was 10 inches.

Respectfully yours,

JOSHUA DOUGHTY, JR.,

Engineer.

CHARLES P. VOORHEES,

Supervisor.

Belvidere, N. J., Oct. 31, 1899.

Mr. Henry I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR:—Below please find a detailed statement of the cost of the road in the town of Belvidere, in the county of Warren, recently built under the provisions of the act of the Legislature of this State, approved March 17, 1899, entitled, "Supplement to an Act entitled, 'An Act to Provide for the Permanent Improvement of Public Roads in this State,' approved March 22d, one thousand eight hundred and ninety-five."

Total length, 388 feet.

(NOTE: This is the length of the street excavated eight inches below grade line and filled in with successive courses of 5 inch, 4 inch and 2 inch; each course being thoroughly rolled and bound together, and afterward about one inch of stone screenings spread over the top and rolled down so that a small stone placed under the roller broke to pieces. In addition, a course of broken stone, about $\frac{3}{4}$ inch in size, was spread over the extensions of Front street on each side of the principal improvement, extending about 400 feet east and 400 feet west, and rolled together; this makes the entire improvement extend about 1,188 feet; but the cost of the improvement, so far as relates to the excavation, macadam, &c., as herewith reported, is for the 388 feet only; the stones, hauling, &c., for the extensions above mentioned having been done by the town authorities independent of the specifications and contract for the improvement.)

Width of stone-bed (average), 37 feet.

Length of stone-bed, 388 feet.

Depth of stone-bed, rolled, 8 inches.

Number of tons of stone used, 621.

Earth excavation, 1,023 yards, at 15 cents per yard.....	\$ 153 45	
Macadam, 1,053 square yards, 621 tons, at 60 cents.....	378 60	
Hauling same, average 15 cents a ton.....	94 65	
Spreading, grading and watering.....	45 50	
Rolling same	42 00	
		\$ 560 75
Hauling gravel and cost of same.....		10 00
Relaying gutters, crossings and cement.....		27 50
Estimated incidental expenses.....		10 00
Estimated contractor's profit.....		38 30
Contract price for doing work and finding material.....		800 00
Supervisor's salary, 30 days.....		90 00
Engineering expenses		40 00

It is to be noted that, as the entire work was done by contract at a lump sum of \$800.00, it cannot be stated with absolute exactness the cost of each item of the work of excavation, rolling the grade bed, gravelling over the first course of 5 inch stones, watering, and minor expenses. The items for crushed stone are believed to be exact, as the town authorities furnished the stone at the town crusher plant and kept a careful account of the loads and weights. As to all other items the supervisor was constantly on the ground, not having missed a single day, and made careful note of days' work, and all other expenses, for the purpose of ascertaining the actual cost of the improvement. After the road bed had been prepared and thoroughly rolled, 5 inch blocks were placed in squares of 8 feet over the surface as the stones were put on; the like course was pursued with the 4 inch and 2 inch courses, each course being watered and rolled so as to make a hard surface before the next course was put on. The depth of the finished work has been ascertained by ten pluggings to be not less anywhere than 8 inches, and in very few places does it exceed this thickness. These pluggings have been made with the utmost care and in accordance with the rules and regulations of the State Commissioner. The stones used are a very hard, blue-flint limestone, and we think the road builded to be one of the very best in the State, as it was intended to be. No engineer was constantly employed, his duties having ended with giving us the original grade stakes before the excavation began, and after the road bed was complete he went over the ground carefully and relocated the grade.

Yours respectfully,
WILLIAM H. MORROW,
Supervisor.

Middletown, N. J., October 7, 1899.

Hon. H. I. Budd, State Commissioner of Public Roads, Trenton, N. J.:

DEAR SIR—We are building our first road in Middletown township, Monmouth county, under the State Aid Road law. The road in question is of gravel varying in width from fourteen to twenty feet, and seven inches in depth in the centre and six inches on the side. It extends from the Atlantic Highlands toward the Navesink or Shrewsbury River, forming one of the links by which we hope to make a continuous county road from Asbury Park through Long Branch, Eatontown, Red Bank, Atlantic Highlands, Keyport and New Brunswick. Several of the above-named places have already been connected by county roads. The above proposed road would connect the interior of our State with the many attractive summer resorts on our coast, thereby being a benefit to people in other portions of the State as well as in this vicinity. As the greater part of the driving in our vicinity is what we term as "light driving," I think that gravel roads are preferable to stone, and if properly built with our best gravel will give general satisfaction. As many of our township gravel roads have not been properly built or cared for, they have not had a fair test as to their durability.

Good gravel is found in large quantities in this section, and the low price

of same in comparison with the cost of stone makes an important item for consideration.

As stone roads are comparatively new in this section, the people have not had enough experience to teach them the relative qualities between stone and gravel.

In building roads of gravel where the same can be obtained at a reasonable price, I would suggest that the gravel be carried out to the gutter line, and to a depth of about three inches at the latter point. I find that rolling is a very important factor. The gravel should be well rolled (after first being wet) when first put on, thereby forming a hard road at once and preserving the shape of same. If gravel is used in which there is a quantity of clay or loam, a top dressing of sand gravel should be used.

The growth of this section of our State, which is composed of a beautiful rolling country within easy access of New York City, has been greatly retarded by the want of good roads. The people have fully awakened to the above fact, and I predict that in the future you will be called upon for all the aid that you can consistently grant.

Respectfully yours,

FRANK OSBORN,
County Engineer.



Franklinville Road,
Gloucester county. After improvement. Gravel.



May's Landing and Egg Harbor City Road,
Atlantic county. Gravel over heavy bed of sand.

APPENDICES.

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APPENDIX A.

PROPOSALS.

*To the Board of Freeholders of the County of.....State
of New Jersey:*

GENTLEMEN—

The undersigned hereby declare that he has carefully examined the annexed specifications and the drawings therein referred to, and will provide all necessary machinery, tools, apparatus and other means of construction, and do all the work and furnish all the material called for by said specifications in the manner prescribed by the specifications and the requirements of the Engineer and Supervisor under them, for the following prices:

(1.) For excavating and removing earth and shale, without classification and measured in excavation, as per cross-sections, throughout the length and width of the road.....per cubic yard.

(2.) For excavating and removing rock, without classification and measured in excavation, as per cross-sections, throughout the length and width of the road.....per cubic yard.

(3.) For furnishing all material and labor for macadamizing roadway with.....inch macadam.....per square yard.

(4.) For furnishing all material and labor for macadamizing roadway with.....inch.....per square yard.

(5.) For under-draining, furnishing all labor and material.....per lineal foot.

(6.) Price (lump) for the whole road complete, according to the specifications and plans prepared by the Engineer.

Accompanying this proposal is an approved bond for the sum of One Thousand (\$1,000.00) Dollars, payable to the order of.....
County Collector of.....County; which bond is to be forfeited as liquidated damages if, in case this proposal is accepted, the undersigned shall fail to execute a contract with said Board of Freeholders, under the conditions of this proposal, within the time provided for by the foregoing advertisement for proposals; otherwise, said bond is to be returned to the undersigned.

Signed :.....

Address,.....

.....N. J.,.....

Amended Form of Specifications Used for Stone Road (Macadam) Under the State Aid Law.

For a macadam stone road in ——— County, New Jersey, known as ——— Road, beginning at ———, in the ——— of ———, extending to ———, a distance of ——— miles.

WORK TO BE PERFORMED.

1. The work to be performed will consist in furnishing all material, tools, machinery and labor necessary and proper for the efficient and proper grading of roadway, side ditches and side banks; laying, spreading and rolling of road metal, and leaving the roadway complete in every manner ready for immediate use.

PLANS, DRAWING.

2. The plans and cross-sections on file at the office of ———, County Engineer, ———, N. J., show general location, profile, details and dimensions, and the work will be constructed in all respects according to the above-mentioned plans and cross-sections which form part of these specifications.

3. Any variation of location, profile, size and dimension from

that shown on the plans as may be required by the exigencies of construction will in all cases be determined by the Engineer; but the contractor shall not on any pretense, save that of the written order of the contracting parties, including the State Commissioner of Public Roads, deviate from the intent of the plans or specifications.

4. On all drawings, figured dimensions are to govern in cases of discrepancy between scale and figure.

GRADING.

5. Under this head will be included all excavation and embankment required for the formation of the highway; cutting all ditches or drains about or contiguous to the road; removing all fences, walls, buildings, trees and poles; the excavation and embankment necessary for re-constructing cross or branch roads in cases where they are destroyed or interfered with in the formation of the roadway, and all other excavations and embankments connected with or incidental to the construction of said road.

EXCAVATION.

6. The roadway to the widths as shown on plans to be excavated or built to a curvature to conform to the final surface of the road when finished; the grade from center to sides being as shown on plans one inch to the foot.

7. The earth taken from any cut or ditch shall be deposited where Engineer may direct, either within or without the lines of the road, but no earth shall be removed from the line of the road without the order of the Engineer.

EMBANKMENT.

8. Material taken from the excavation, except when otherwise directed by the Engineer, shall be deposited in the embankment; the cost of removing such shall be included in the price paid for excavation. The price paid for excavation will be un-

derstood to cover and pay for the entire expense of its removal by any method whatever, including loading, transportation and deposit, in the manner prescribed in these specifications, in the places designated by the Engineer.

9. All material necessarily procured from without the road and deposited in the embankment will be paid for as excavation only.

10. The embankments will be formed in layers of such depth (generally six (6) inches), each layer to be thoroughly rolled and the material deposited and distributed in such a manner as the Engineer may direct, the required allowance for settling being added.

SLOPES.

11. Slopes in both embankment and excavation shall be one and one-half ($1\frac{1}{2}$) horizontal to one (1) vertical, according to slope stakes, unless otherwise ordered.

CONSTRUCTION.

12. The construction to be macadam, not less than — inches in depth when completed, and when finally accepted, depth to be determined by plugging at frequent intervals, and — feet and — feet wide respectively, as shown on plans.

ROADWAY.

Sub-Foundations.

13. When the excavations and embankments have been brought to a proper depth below the intended surface of the roadway, and the cross-section thereof, conforming in every respect to the cross-section of the road when finished, the same shall be rolled with a ten (10) ton staem-roller until approved by the Engineer. If any depressions form under such rolling, owing to improper material or vegetable matter, the same shall be removed and good earth substituted, and the whole re-rolled until thoroughly solid and to above-mentioned grade.

14. After the road-bed has been prepared and properly rolled, it shall not be disturbed by any carting or hauling upon the surface.

MACADAM.

First Course of Broken Stone.

15. After the road-bed has been formed and rolled, as above specified, and has passed the inspection of the Engineer and Supervisor, the first layer or broken stone, consisting of two and one-half ($2\frac{1}{2}$) inch stone, or stone that will pass through a ring three (3) inches in diameter, shall be deposited in a uniform layer, to a depth of — inches and rolled to — inches, and rolled repeatedly with a ten (10) ton steam-roller until compacted to the satisfaction of the Engineer and Supervisor.

BINDER BETWEEN FIRST AND SECOND COURSE.

16. On both the first and second courses of stone a quantity of stone-screening shall be spread in a uniform layer and the rolling continued until the stone cease to sink or creep in front of the roller; water will be applied in advance of the roller, but not in excess. The quantity and quality of this to be at all times subject to the approval of the Engineer.

SECOND COURSE OF BROKEN STONE.

17. The second course of broken stone shall consist of one and one-half ($1\frac{1}{2}$) inch stone—that is, every piece of stone shall be broken so it can be passed through a ring one-half ($\frac{1}{2}$) inch in diameter, and no stone shall be more than two (2) inches or less than one (1) inch long. This course to be spread in a uniform layer, having a depth of — inches and rolled to — inches, and rolled repeatedly with a ten (10) ton steam-roller until compacted to the satisfaction of the Engineer and Supervisor. Depth of loose stone in both first and second course to be measured by loose blocks of the required thickness of the loose stone; to be

placed on the road-bed at frequent intervals amid the loose stone when being spread.

SURFACE.

18. When the two courses are rolled to the satisfaction of the Engineer and Supervisor, a coat of three-quarter ($\frac{3}{4}$) inch stone and screenings is to be spread of sufficient thickness to make a smooth and uniform surface to the road, then again thoroughly rolled until the road becomes thoroughly consolidated, hard and smooth, and a small stone placed on the surface will be broken before being driven into the bed.

19. Rolling to be done by contractor with a ten (10) ton steam-roller, approved by the Engineer.

20. Any depressions formed during the rolling, or from any other cause, are to be filled with three-quarter ($\frac{3}{4}$) inch stone and screenings, and the roadway brought to a proper grade and curvature as determined by the Engineer.

21. Water must be applied in such quantities and in such manner as to completely fill all the voids between the broken stone, with the binding material saturated so as to secure a set.

MANNER OF ROLLING.

22. In the rolling the roller must start from the side lines of the stone bed and work towards the center, unless otherwise directed. The rolling shall at all times be subject to the directions of the Engineer and Supervisor, who may, from time to time, direct such methods of procedure as in their opinion the necessities of the case may require.

QUALITY OF MATERIAL.

23. All stone must be as nearly cubical as possible, broken with the most approved modern stone-crushing machinery, free from all screenings, earth and other objectionable substances, of uniform size and the same kind and quality, or equally as good

in every particular as that shown in the Engineer's office. The one and one-half ($1\frac{1}{2}$) inch stone, three-quarter ($\frac{3}{4}$) inch and screenings for binder and final finish must be of the best trap-rock, free from loam and clay.

24. The contractor must furnish samples of the kind of stone to be used in the work to the Engineer before the opening of the bids.

SHOULDERING.

25. A shoulder of firm earth or gravel is to be left or made on each side, extending at the same grade and curvature of road to side ditches or gutters. This shoulder is to be thoroughly rolled for its entire width on each side of the stone bed; this shoulder to never be of a less width than seven (7) feet from the stone bed, where the width of the road will admit.

26. When necessary the side ditches or gutters are to be excavated as per stakes furnished by Engineer, to give an easy flow of water, so that no water shall be left standing on the road or in the ditches, for all of which no extra payment will be made.

UNDER-DRAINS.

27. Under-drains, if found necessary, shall be constructed by the contractor (at prices named in bids) of good four (4) inch tile, laid upon a board of not less than one (1) inch in thickness and six (6) inches in width, whenever and wherever the Engineer shall decide; top of tile to be at least thirty (30) inches deep, unless otherwise directed by the Engineer, the joints of the tile to be covered with salt hay or something equally as good, and trench filled with pervious earth; or a drain (trench) constructed of stone.

NO EXTRA PRICE.

28. No allowance in measure of depth of pavement will be made on account of any material which may be driven into the road-bed by rolling. The pavement, when completed, must con-

form to the grade and cross section, and be satisfactory to the Engineer, whose decision shall be final.

29. No extra work will be paid for unless the price has been agreed between the contracting parties, including the State Commissioner of Public Roads, and endorsed upon the agreement, witnessed by the Engineer.

30. When extra depth of pavement is required, it must be obtained by making the pavement thinner on the more solid portions of the road. Changes in depth to be made only upon the written order of Engineer and State Commissioner of Public Roads, and as located by them.

31. All clay or gravel for shouldering and all extra hauling to be at the contractor's expense.

BIDS.

32. Bids will only be received under these specifications for the road complete. The prices per yard for excavating and macadam are intended for the use of the Engineer in making monthly estimate of work done to the Board of Freeholders. No bids will be received in which all of the following items are not filled out:

(1) Price per cubic yard for earth excavations, without classification, as per cross-sections throughout the length and width of the road.

(2) Price per cubic yard for rock excavations, without classification, as per cross-sections throughout the length and width of the road.

(3) Price per square yard for four (4) inch macadam road complete.

(4) Price per square yard for six (6) inch macadam road complete.

(5) Price per square yard for eight (8) inch macadam road complete.

(6) Price per lineal foot, for under-drains, furnishing all labor and material.

(7) Price (lump) for the whole road complete, according to above specifications, and plans prepared by the Engineer.

ESTIMATE OF QUANTITIES.

33. (1) Excavations, _____ cubic yards.
(2) Four (4) inch macadam, _____ square yards.
(3) Six (6) inch macadam, _____ square yards.
(4) Eight (8) inch macadam, _____ square yards.
(5) Under-drains, _____ lineal feet.

34. These quantities are the result of careful calculation, but are to be considered as approximate. The County will not be responsible for any excess in above quantities, should any occur. The contractor is expected to satisfy himself as to the nature, character and quantity of the labor and material required by a personal examination of the work contemplated.

35. Bids shall be accompanied by cash or certified check, to insure the execution of the agreement, to the amount of at least One Thousand (\$1,000.00) Dollars.

LIABILITIES OF CONTRACTOR.

36. He shall keep up sufficient guards by day and night to prevent accidents from travel, and will be liable for any damage which may arise by his neglect to do so, or from any omission on his part.

37. He shall keep the road sprinkled until the final certificate of completion by the Engineer is given.

38. He is to commence and prosecute the work upon the road at such points as may be directed by the Engineer and Supervisor, within _____ days from and after the signing of the contract, and shall continue work thereon until completion, except as herein provided.

39. He further agrees to complete the same on or before the _____ day of _____, A. D. _____. Twenty dollars for each day that the work shall remain uncompleted after the time allowed by contract may be deducted from any moneys due contractor, as liquidated damages. A bonus or premium of \$1.00 per month will be paid the contractor for each month the road is completed before the time specified in the contract, except only

to the provisions herein contained, unless otherwise agreed upon by the Board of Freeholders, on certificate of the Engineer recommending the extension of the time-limit of completion.

40. The contractor shall keep the finished roadway and earth-work in repair and contract depth for the space of one year from the date of its completion and acceptance, and shall be liable for wear and tear caused by ordinary travel, and as much longer as for any period or periods during said year it shall be out of proper condition; and if during that time the roadway or any part of the work shall, in the judgment of the Engineer and Board of Freeholders, require repairing; and they shall duly notify the contractor to make repairs as required, and if the contractor shall refuse or neglect to do so, to the satisfaction of the said Engineer and Board of Freeholders, within five days from the date of service of notice, then said Engineer and Board of Freeholders shall have the right to have the work done properly by other parties and pay the expense for the same out of the ten per cent. retained.

41. The contractor will be required to preserve all stakes and bench-marks made and established on the line of the work, until duly authorized by the Engineer to remove the same.

42. The contractor shall not disturb the position of title stones (the corners to properties adjacent to road) : where they appear he will either lift or lower them so that their tops may conform with the finished surface of the stone construction, under the personal supervision of the Engineer.

43. The contractor must also preserve the roadway on which he is working from needless obstruction, and where necessary will construct safe and commodious crossings, to be maintained in good order, and to afford all proper and reasonable means for the accommodation of the public.

ENGINEER.

44. The Engineer is to be selected or appointed by the Freeholders and paid by them. He is to furnish all surveys, profiles, plans, specifications and quantities of all kinds before specifica-

tions are signed, and in such a clear manner that lump bids can be made upon the work. He is to place stakes at small intervals on opposite sides of the road, marked for the finished grade, so that by line and rule the depth of pavement can be easily and correctly determined. He is also to furnish estimates of quantities of work done before partial payments are made, the quantity of road laid to be determined by surface measurement, and should any difference arise between the contracting parties as to their meanings, his decisions on these matters are to be final and conclusive. The work is to be done according to his direction, and if any material is brought upon the road not approved by him, it is to be removed at the expense of the contractor.

RIGHT TO BUILD BRIDGES, CULVERTS, &C., AND SUSPENSION OF WORK.

45. The right of the county to build bridges, culverts, or lay pipes or other appurtenances in connection therewith, in said road, during the progress of the work, is expressly reserved, as well as suspending the work, or any part thereof, during the construction of the same for the purpose above stated, without further compensation to the contractor for such suspension than an extension of time for completing the work as much as it may have been delayed by such suspension.

STOPPING WORK ON ACCOUNT OF WEATHER.

46. The Supervisor, in his discretion, may stop any portion of the work if, in his judgment, the weather is such as to prevent the same being done properly. No allowance of any kind will be made for such stoppage, except an extension of the time for the completion of the work, as herein provided for.

ABANDONMENT OF CONTRACT.

47. If at any time the work under contract should be abandoned, or if at any time the Supervisor or Engineer should judge and so certify in writing that said work or any part thereof is

unnecessarily delayed, or that the contractor is willfully violating any of the conditions or covenants of this contract, or is executing the same in bad faith, the Board shall thereupon notify the said contractor to discontinue all work under this contract, and may employ other parties to complete the work in such manner as they may decide, and use such material as they may find upon the line of said work, and to procure other material for its completion, and charge the expense of the said labor and material to the contractor, to be deducted from any moneys due him under contract, and in case such expenses shall exceed the sum which would have been payable under contract, if the same had been completed by said contractor, he or his bondsmen shall pay the amount of the excess to the Board of Freeholders, on notice from the Engineer.

SUPERVISOR.

48. Nothing in these specifications, relating to the duties of the Engineer, shall be taken or construed to, in any manner, conflict with the duties of the Supervisor in the performance of his duties, as specifically set forth in the act entitled "An act to provide for the more permanent improvement of the public roads of this State," approved March 22d, 1895, and the supplements thereto, but they shall co-operate as far as practicable. The contractor shall employ competent men to do the work, and, whenever the Supervisor shall inform him in writing that any man on the work is unfitted for the place, or is working contrary to the provisions of the specifications or the instructions of the Engineer, he shall thereupon be discharged.

INSPECTION.

49. All directions and determinations, necessary to give due and full effect to any of the provisions of these specifications, shall be given by the Engineer and Supervisor.

50. All material and workmanship of any kind shall be subject at all times to the inspection of the Engineer and Supervisor. Whenever unfaithful and imperfect work is discovered it shall

be repaired or replaced by the contractor, after due notification from the Engineer and Supervisor.

SUB-LETTING OF CONTRACT.

51. The contractor shall not assign or sub-let any portion of this contract without the consent of the Board of Freeholders and the State Road Commissioner.

PAYMENTS.

52. Monthly payments will be made by the Board of Freeholders to the contractor, if desired, for all completed work, upon presentation by him of the proper certificates of the Engineer and Supervisor to the extent of eighty per cent. of the amount then due. Ten per cent. will be paid at the completion of the work. The balance (ten per cent.) will be retained by the said Board of Freeholders to keep the roadway completed by the contractor in good repair and at contract depth in case said contractor fails to do so during the period of one year, after the expiration of which time and the final release of the contractor the said balance of ten per cent., or such portion of it as has not been expended as aforesaid, will be paid over to the contractor.

BOND OF CONTRACTOR.

53. The contractor will be required to execute, within five days after giving of contract, a bond in such sum and with such securities, and not less than fifty per cent. of the cost of the road when completed, as shall be approved by the Board of Freeholders or its committee, conditioned for the faithful performance of the contract, and to indemnify and save harmless the parties of the said Board of Freeholders or its committee from all suits or actions of any name or description brought against them for or on account of any injuries or damages received or sustained by any party or parties, by or from the said contractor, his servants or agents, in the construction of said work, or by or in consequence

of any negligence in guarding the same, or any improper material used in its construction, or by or on account of any act or omission of the contractor or his agents, and for the faithful performance of the contract by the contractor, and the said contractor hereby further agrees that so much of the money due him under and by virtue of this agreement, as shall be considered necessary by the Board of Freeholders or its committee, may be retained by the said Board of Freeholders or its committee until all such suits or claims for damages aforesaid shall have been settled, and evidence to that effect furnished to the satisfaction of the said Board of Freeholders or its committee.

CONTRACTOR TO INSURE PAYMENT FOR LABOR, MATERIAL, &C., ON
FINAL ESTIMATE.

54. The contractor must also furnish said Engineer and Supervisor with satisfactory evidence that all persons who did work or furnished material for this contract, or who have sustained damage or injury by reason of any act, omission or carelessness on his part or his agents, in the prosecution of the work, have been fully paid and secured; and shall also give notice to said Engineer and Supervisor within ten (10) days after the completion of the work, that any balance for such work or materials, or compensation for such damage still due, has been fully paid or released.

PERSONAL ATTENTION.

55. The contractor must give his personal attention to the work and not assign or sub-let the same, but keep the same under his control.

_____,
County Engineer.

_____,
_____,
_____,
_____,
_____,

Road Committee.

Approved this ———, A. D. ———, by resolution of the Board of Chosen Freeholders.

—————, Director Board of Chosen Freeholders.

—————, Clerk of Board of Chosen Freeholders.

OFFICE STATE COMMISSIONER OF PUBLIC ROADS,
TRENTON, N. J.

I have this day carefully read and examined the foregoing specifications, and the same are hereby approved.

Any departure from these specifications which increases the cost of the road must have the written consent of the State Commissioner of Public Roads.

Given under my hand, this ———, A. D. ———.

—————, State Commissioner of Public Roads.

**Form of Specifications in use for Telford Macadam Stone Road
under the State Aid Law.**

Specifications for a Telford macadam stone road in ——— County, New Jersey, known as ——— Road, beginning at ———, in the ———, extending to ———, a distance of ——— miles.

WORK TO BE PERFORMED.

1. The work to be performed will consist in furnishing all material, tools, machinery and labor necessary and proper for the efficient and proper grading of roadway, side ditches and side banks; laying, spreading and rolling of road metal, and leaving the roadway complete in every manner ready for immediate use.

PLANS, DRAWINGS.

2. The plans and cross-sections on file at the office of ———, County Engineer, ———, N. J., show general location, profile, details and dimensions, and the work will be constructed in all respects according to the above-mentioned plans and cross-sections which form part of these specifications.

3. Any variation of location, profile, size and dimension from that shown on the plans as may be required by the exigencies of construction will in all cases be determined by the Engineer; but the contractor shall not on any pretense, save that of the written order of the contracting parties, including the State Commissioner of Public Roads, deviate from the intent of the plans or specifications.

4. On all drawings, figured dimensions are to govern in cases of discrepancy between scale and figure.

GRADING.

5. Under this head will be included all excavation and embankment required for the formation of the highway; cutting all ditches or drains about or contiguous to the road; removing all fences, walls, buildings, trees and poles; the excavation and embankment necessary for reconstructing cross or branch roads in cases where they are destroyed or interfered with in the formation of the roadway, and all other excavations and embankments connected with or incidental to the construction of the said road.

EXCAVATION.

6. The roadway to the widths as shown on plans to be excavated or built to a curvature to conform to the final surface of the road when finished; the grade from center to sides being as shown on plans.

7. The earth taken from any cut or ditch shall be deposited where Engineer may direct, either within or without the lines of the road, but no earth shall be removed from the line of the road without the order of the Engineer.

EMBANKMENT.

8. Material taken from the excavation, except when otherwise directed by the Engineer, shall be deposited in the embankment; the cost of removing such shall be included in the price paid for excavation. The price paid for excavation will be understood to cover and pay for the entire expense of its removal by any method whatever, including loading, transportation and deposit, in the manner prescribed in these specifications, in the places designated by the Engineer.

9. All material necessarily procured from without the road and deposited in the embankment will be paid for as excavation only.

10. The embankments will be formed in layers of such depth (generally six (6) inches), and the material deposited and distributed in such a manner as the Engineer may direct, the required allowance for settling being added.

SLOPES.

11. Slopes in both embankment and excavation shall be one and one-half ($1\frac{1}{2}$) horizontal to one (1) vertical, according to slope stakes, unless otherwise ordered.

CONSTRUCTION.

12. The construction to be Telford bottom, ——— inches, and macadam surface, ——— inches; total depth when completed and finally accepted, ——— inches and ——— feet, and ——— feet wide respectively, as shown on plans.

ROADWAY.

Sub-Foundations.

13. When the excavations and embankments have been brought to a proper depth below the intended surface of the roadway, and the cross-section thereof, conforming in every respect

to the cross-section of the road when finished, the same shall be rolled with ——— roller until approved by the Engineer. If any depressions form under such rollings, owing to improper material or vegetable matter, the same shall be removed and good earth substituted, and the whole re-rolled until thoroughly solid and to above-mentioned grade.

14. After the roadbed has been prepared and properly rolled, it shall not be disturbed by any carting or hauling upon the surface.

TELFORD FOUNDATIONS.

15. After the road-bed has been formed and rolled, as above specified, and has passed the inspection of the Engineer and Supervisor, a bottom course of stone, of average depth of ——— inches, to be set by hand as a close, firm pavement, the stones to be placed on their broadest edges, lengthwise across the road, and so as to break joints as much as possible, the breadth of the upper edge not to exceed four (4) inches. The interstices are then to be filled with stone chips, firmly wedged by hand with hammer and projecting points broken off. No stone to be used of a greater length than ten (10) inches or width of four (4) inches, except each alternate stone on outer edge, which shall be double the length of the others and well tied into the bed of the road; all stone with a flat, smooth surface to be broken. The whole surface of this pavement to be subjected to a thorough settling or ramming with heavy sledge hammers and thoroughly rolled with a five or seven-ton roller. No stones larger than one and one-half ($1\frac{1}{2}$) inches to be left on top of Telford.

BINDER BETWEEN FIRST AND SECOND COURSE.

16. On the Telford course of stone a quantity of ——— binder shall be spread in a uniform layer and the rolling continued until the stone cease to sink or creep in front of the roller; water will be applied in advance of the roller, but not in excess. The quantity and quality of this and all other binding to be at all times subject to the approval of the Engineer.

SECOND COURSE OF BROKEN STONE.

17. The second course of broken stone shall consist of one and one-half ($1\frac{1}{2}$) inch stone, that is, every piece of stone shall be broken so it can be passed through a ring two (2) inches in diameter, and no stone shall be more than two (2) inches or less than one (1) inch long. This course is to be spread in a uniform layer of sufficient thickness to make the macadam at least ——— inches and ——— inches in depth respectively, when completed, including the three-quarter ($\frac{3}{4}$) inch stone and screenings for the surface, and rolled until thoroughly settled into place to the satisfaction of the Engineer and Supervisor.

SURFACE.

18. When the two courses are rolled to the satisfaction of the Engineer and Supervisor, a coat of three-quarter ($\frac{3}{4}$) inch stone and screenings is to be spread of sufficient thickness to make a smooth and uniform surface to the road, then again thoroughly rolled until the road becomes thoroughly consolidated, hard and smooth, and a small stone placed on the surface will be broken before being driven into the bed.

19. Rolling to be done by contractor with a ten (10) ton steam-roller, approved by the Engineer.

20. Any depressions formed during the rolling, or from any other cause, are to be filled with three-quarter ($\frac{3}{4}$) inch stone and screenings, and the roadway brought to a proper grade and curvature as determined by the Engineer.

21. Water must be applied in such quantities and in such manner as to completely fill all the voids between the broken stone, with the binding material saturated so as to secure a set.

MANNER OF ROLLING.

22. In the rolling the roller must start from the side lines of the stone bed and work towards the center, unless otherwise directed. The rolling shall at all times be subject to the directions

of the Engineer and Supervisor, who may, from time to time, direct such methods of procedure as in their opinion the necessities of the case may require.

QUALITY OF MATERIAL.

23. All stone must be as nearly cubical as possible, broken with the most approved modern stone crushing machinery, free from all screenings, earth and other objectionable substances, of uniform size and the same kind and quality, or equally as good in every particular as that shown in the Engineer's office. The one and one-half ($1\frac{1}{2}$) inch stone, three-quarter ($\frac{3}{4}$) inch and screenings for binder and final finish must be of the best trap-rock, free from loam or clay.

24. The contractor must furnish samples of the kind of stone to be used in the work to the Engineer before the opening of the bids.

SHOULDERING.

25. A shoulder of firm earth or gravel is to be left or made on each side, extending at the same grade and curvature of road to side ditches or gutters. This shoulder is to be thoroughly rolled for its entire width on each side of the stone bed.

26. When necessary the side ditches or gutters are to be excavated as per stakes furnished by Engineer to give an easy flow of water, so that no water shall be left standing on the road or in the ditches, for all of which no extra payment will be made.

UNDER-DRAINS.

27. Under-drains, if found necessary, shall be constructed by the contractor (at prices named in bids) of good four (4) inch tile, laid upon a board of not less than one (1) inch in thickness and six (6) inches in width, whenever and wherever the Engineer shall decide; top of tile to be at least thirty (30) inches deep, unless otherwise directed by the Engineer, the joints of the tile to be covered with salt hay or material equally as good and trench filled with pervious earth.

NO EXTRA PRICE.

28. No allowance in measure of depth of pavement will be made on account of any material which may be driven into the road-bed by rolling. The pavement, when completed, must conform to the grade and cross-section and be satisfactory to the Engineer, whose decision shall be final.

29. No extra work will be paid for unless the price has been agreed between the contracting parties, including the State Commissioner of Public Roads, and endorsed upon the agreement, witnessed by the Engineer.

30. When extra depth of pavement is required, it must be obtained by making the pavement thinner on the more solid portions of the road. Changes in depth to be made only upon the written order of Engineer and State Commissioner of Public Roads and as located by them.

31. All clay or gravel for shouldering and all extra hauling to be at the contractor's expense.

BIDS.

32. Bids will only be received under these specifications for the road complete. The prices per yard for excavating and macadam are intended for the use of the Engineer in making monthly estimates of work done to the Board of Freeholders. No bids will be received in which all of the following items are not filled out:

(1) Price per cubic yard for earth and shale excavations, without classification, as per cross-sections throughout the length and width of the road.

(2) Price per cubic yard for rock excavations, without classification, as per cross-sections throughout the length and width of the road.

(3) Price per square yard for ——— inch Telford macadam road complete.

(4) Price per lineal foot, for under-drains, furnishing all labor and material.

(5) Price (lump) for the whole road complete, according to above specifications, and plans prepared by the Engineer.

ESTIMATES OF QUANTITIES.

33. (1) Excavations, earth, ——— cubic yards.
(2) Excavations, rock, ——— cubic yards.
(3) ——— inch Telford macadam, ——— square yards.
(4) Under-drains, ——— lineal feet.

34. These quantities are the result of careful calculation, but are to be considered as approximate. The County will not be responsible for any excess in above quantities, should any occur. The contractor is expected to satisfy himself as to the nature, character and quantity of the labor and material required by a personal examination of the work contemplated.

35. Bids shall be accompanied by cash or certified check, to insure the execution of the agreement, to the amount of at least One Thousand (\$1,000.00) Dollars.

LIABILITIES OF CONTRACTOR.

36. He shall keep up sufficient guards by day and night to prevent accidents from travel, and will be liable for any damage which may arise by his neglect to do so or from any omission on his part.

37. He shall keep the road sprinkled until the final certificate of completion by the Engineer is given.

38. He is to commence and prosecute the work upon the road at such points as may be directed by the Engineer and Supervisor, within ——— days from and after the signing of the contract, and shall continue work thereon until completion, except as herein provided.

39. He further agrees to complete the same on or before the ——— day of ———, A. D. ———. Twenty dollars for each day that the work shall remain uncompleted after the time allowed by contract may be deducted from any moneys due contractor, as liquidated damages. A bonus or premium of \$1.00

per month will be paid the contractor for each month the road is completed before the time specified in the contract, except only to the provisions herein contained, unless otherwise agreed upon by the Board of Freeholders, on certificate of the Engineer recommending the extension of the time limit of completion.

40. The contractor shall keep the finished roadway and earth-work in repair for the space of one year from the date of its completion and acceptance, and shall be liable for wear and tear caused by ordinary travel, and as much longer as for any period or periods during said year it shall be out of proper condition; and if, during that time, the roadway or any part of the work shall, in the judgment of the Engineer and Board of Freeholders, require repairing, and they shall duly notify the contractor to make repairs as required, and if the contractor shall refuse or neglect to do so, to the satisfaction of the said Engineer and Board of Freeholders, within five days from the date of service of notice, then said Engineer and Board of Freeholders shall have the right to have the work done properly by other parties and pay the expense for the same out of the five per cent. retained.

41. The contractor will be required to preserve all stakes and bench-marks made and establish on the line of the work until duly authorized by the Engineer to remove same.

42. The contractor shall not disturb the position of title stones (the corners to properties adjacent to road); where they appear he will either lift or lower them so that their tops may conform with the finished surface of the stone construction under the personal supervision of the Engineer.

43. The contractor must also preserve the roadway on which he is working from needless obstruction, and where necessary will construct safe and commodious crossings, to be maintained in good order, and to afford all proper and reasonable means for the accommodation of the public.

ENGINEER.

44. The Engineer is to be selected or appointed by the Freeholders and paid by them. He is to furnish all surveys, profiles,

plans, specifications and quantities of all kinds before specifications are signed, and in such a clear manner that lump bids can be made upon the work. He is to place stakes at small intervals on opposite sides of the road, marked for the finished grade, so that by line and rule the depth of pavement can be easily and correctly determined. He is also to furnish estimates of quantities of work done before partial payments are made, the quantity of road laid to be determined by surface measurement, and should any difference arise between the contracting parties as to their meanings, his decisions on these matters are to be final and conclusive. The work is to be done according to his direction, and if any material is brought upon the road not approved by him it is to be removed at the expense of the contractor.

RIGHT TO BUILD BRIDGES, CULVERTS, &C., AND SUSPENSION OF
WORK.

45. The right of the county to build bridges, culverts or lay pipes or other appurtenances in connection therewith in said road, during the progress of the work, is expressly reserved, as well as suspending the work or any part thereof during the construction of the same for the purpose above stated, without further compensation to the contractor for such suspension than an extension of time for completing the work as much as it may have been delayed by such suspension.

STOPPING WORK ON ACCOUNT OF WEATHER.

46. The Supervisor, in his discretion, may stop any portion of the work if, in his judgment, the weather is such as to prevent the same being done properly. No allowance of any kind will be made for such stoppage except an extension of the time for the completion of the work as herein provided for.

ABANDONMENT OF CONTRACT.

47. If at any time the work under contract should be abandoned, or if at any time the Supervisor or Engineer should judge and so certify in writing that said work or any part thereof is unnecessarily delayed, or that the contractor is willfully violating any of the conditions or covenants of this contract, or is executing the same in bad faith, the Board shall thereupon notify the said contractor to discontinue all work under this contract, and may employ other parties to complete the work in such manner as they may decide, and use such material as they may find upon the line of said work, and to procure other material for its completion, and charge the expense of the said labor and material to the contractor, to be deducted from any moneys due him under contract, and in case such expenses shall exceed the sum which would have been payable under contract, if the same had been completed by said contractor, he or his bondsmen shall pay the amount of the excess to the Board of Freeholders, on notice from the Engineer.

SUPERVISOR.

48. Nothing in these specifications, relating to the duties of the Engineer, shall be taken or construed to in any manner conflict with the duties of the Supervisor in the performance of his duties, as specifically set forth in the act entitled "An act to provide for the more permanent improvement of the public roads of this State," approved March 22d, 1895, and the supplements thereto, but they shall co-operate as far as practicable. The contractor shall employ competent men to do the work, and, whenever the Supervisor shall inform him in writing that any man on the work is unfitted for the place, or is working contrary to the provisions of the specifications or the instructions of the Engineer, he shall thereupon be discharged.

INSPECTION.

49. All directions and determinations, necessary to give due and full effect to any of the provisions of these specifications, shall be given by the Engineer and Supervisor.

50. All material and workmanship of any kind shall be subject at all times to the inspection of the Engineer and Supervisor. Whenever unfaithful and imperfect work is discovered it shall be repaired or replaced by the contractor, after due notification from the Engineer and Supervisor.

SUB-LETTING OF CONTRACT.

51. The contractor shall not assign or sub-let any portion of this contract without the consent of the Board of Freeholders and the State Commissioner of Public Roads.

PAYMENTS.

52. Monthly payments will be made by the Board of Freeholders to the contractor, if desired, for all completed work, upon presentation by him of the proper certificates of the Engineer and Supervisor to the extent of eighty per cent. of the amount then due. Fifteen per cent. will be paid at the completion of the work. The balance (five per cent.) will be retained by the said Board of Freeholders to keep the roadway, completed by the contractor, in good repair, in case said contractor fails to do so during the period of one year, after the expiration of which time and the final release of the contractor the said balance of five per cent., or such portion of it as has not been expended as aforesaid, will be paid over to the contractor.

BOND OF CONTRACTOR.

53. The contractor will be required to execute, within five days after giving of contract, a bond in such sum and with such securities, and not less than fifty per cent. of the cost of the road when

completed, as shall be approved by the Board of Freeholders or its committee, conditioned for the faithful performance of the contract and to indemnify and save harmless the parties of the said Board of Freeholders or its committee from all suits or actions of any name or description brought against them for or on account of any injuries or damages received or sustained by any party or parties, by or from the said contractor, his servants or agents, in the construction of said work, or by or in consequence of any negligence in guarding the same, or any improper material used in its construction, or by or on account of any act or omission of the contractor or his agents, and for the faithful performance of the contract by the contractor, and the said contractor hereby further agrees that so much of the money due him under and by virtue of this agreement, as shall be considered necessary by the Board of Freeholders or its committee, may be retained by the said Board of Freeholders or its committee until all such suits or claims for damages aforesaid shall have been settled, and evidence to that effect furnished to the satisfaction of the said Board of Freeholders or its committee.

CONTRACTOR TO INSURE PAYMENT FOR LABOR, MATERIAL, &C.,
ON FINAL ESTIMATE.

54. The contractor must also furnish said Engineer and Supervisor with satisfactory evidence that all persons who did work or furnished material for this contract, or who have sustained damage or injury by reason of any act, omission or carelessness on his part or his agents, in the prosecution of the work, have been fully paid and secured; and shall also give notice to said Engineer and Supervisor within ten (10) days after the completion of the work, that any balance for such work or materials, or compensation for such damage still due, has been fully paid or released.

PERSONAL ATTENTION.

55. The contractor must give his personal attention to the work and not assign or sub-let the same, but keep the same under his control.

_____,
County Engineer.

_____,
_____,
_____,
_____,
_____,

Road Committee.

Approved this _____, A. D. _____, by resolution of the Board of Chosen Freeholders.

_____,
Director Board of Chosen Freeholders.

_____,
Clerk of Board of Chosen Freeholders.

OFFICE STATE COMMISSIONER OF PUBLIC ROADS,

TRENTON, N. J.

I have this day carefully read and examined the foregoing specifications, and the same are hereby approved.

Any departure from these specifications which increases the cost of the road must have the written consent of the State Commissioner of Public Roads.

Given under my hand, this _____, A. D. _____.

_____,
State Commissioner of Public Roads.

Form of Specifications used for Gravel Road Under the State Aid Law.

Specifications for a gravel road in ——— County, New Jersey, known as ——— Road, beginning at ———, in the ———, extending to ———, a distance of ——— miles.

WORK TO BE PERFORMED.

1. The work to be performed will consist in carting all material, tools, machinery and labor necessary and proper for the efficient and proper grading and rolling of roadway, side ditches and side banks; laying, spreading and rolling of gravel, and leaving the roadway complete in every manner ready for immediate use.

PLANS, DRAWINGS.

2. The plans and cross-sections on file at the office of ——— show general location, profile, details and dimensions, and the work will be constructed in all respects according to the above-mentioned plans and cross-sections which form part of these specifications.

3. Any variation of location, profile, size and dimension from that shown on the plans as may be required by the exigencies of construction will in all cases be determined by the Engineer; but the contractor shall not on any pretense, save that of the written order of the contracting parties, including the State Commissioner of Public Roads, deviate from the intent of the plans or specifications.

4. On all drawings, figured dimensions are to govern in cases of discrepancy between scale and figure.

GRADING.

5. Under this head will be included all excavation and embankment required for the formation of the highway; cutting all ditches or drains about or contiguous to the road; removing all

fences, walls, buildings, trees and poles; the excavation and embankment necessary for reconstructing cross or branch roads in cases where they are destroyed or interfered with in the formation of the roadway, and all other excavations and embankments connected with or incidental to the construction of the said road.

EXCAVATION.

6. The roadway to be prepared to receive a gravel bed ——— feet wide, as shown on plans, and to be excavated or built to a curvature to conform to the final surface of the road when finished; the grade from center to sides being as shown on plans, one inch fall to each foot.

7. The earth taken from any cut or ditch shall be deposited where Engineer may direct, either within or without the lines of the road, but no earth shall be removed from the line of the road without the order of the Engineer.

EMBANKMENT.

8. Material taken from the excavation, except when otherwise directed by the Engineer, shall be deposited in the embankment; the cost of removing such shall be included in the price paid for excavation. The price paid for excavation will be understood to cover and pay for the entire expense of its removal by any method whatever, including loading, transportation and deposit, in the manner prescribed in these specifications, in the places designated by the Engineer.

9. All material necessarily procured from without the road and deposited in the embankment will be paid for as excavation only.

10. The embankments will be formed in layers of such depth (generally six (6) inches), and the material deposited and distributed in such a manner as the Engineer may direct, the required allowance for settling being added.

SLOPES.

11. Slopes in both embankment and excavation shall be one and one-half ($1\frac{1}{2}$) horizontal to one (1) vertical, according to slope stakes, unless otherwise ordered.

ROADWAY.

Sub-Foundations.

12. When the excavations and embankments have been brought to a proper depth below the intended surface of the roadway, and the cross-section thereof, conforming in every respect to the cross-section of the road when finished, the same shall be rolled with ——— roller until approved by the Engineer. If any depressions form under such rolling, owing to improper material or vegetable matter, the same shall be removed and good earth substituted, and the whole re-rolled until thoroughly solid and to above-mentioned grade.

13. After the road-bed has been prepared and properly rolled, it shall not be disturbed by any carting or hauling upon the surface.

MATERIAL.

14. The Road Committee, in conjunction with the Engineer, subject to the approval of the Board, will locate all gravel to be used in the surfacing of this road, and the said Board will pay for all this gravel when the same is not donated, without any cost to contractor.

15. The contractor is to dig, cart, and place upon the road, in accordance with the specifications, the gravel selected and to use no other gravel.

16. Should any objectionable material be used he is to remove the same at his own expense.

CONSTRUCTION.

17. The gravel is to be placed upon the road in layers, then to be thoroughly harrowed, mixed and rolled with roller approved by the Engineer, until it is thoroughly consolidated and firm. The whole of sufficient thickness that when it is thoroughly rolled and solidified the solid gravel will be ——— deep in the center and slope at a regular grade to ——— in depth at a distance of ——— feet on each side of the center line of road. Should any inequalities appear during the rolling, these are to be carefully filled with gravel so that the finished road will conform to the approved profile; no extra pay will be allowed for material required to fill these depressions.

18. The contractor is to be paid by the cubic yard for the compacted gravel that he puts on the road and to be measured on the road after it is thoroughly rolled, at the price named in the accepted bid, which is to include the loading, carting, spreading, mixing, harrowing and finishing the road and shaping the local earth shoulder.

SIDEWALK.

19. The contractor will also be required, when the Engineer so directs, to grub and remove from sidewalk or strip of land ——— feet wide on outside of curblines, all material objectionable to the Engineer, such as trees, stumps, roots, brush, &c., thereby completing the opening of the entire road to the width of ——— feet, which will be ——— feet on each side of the center line.

20. The grubbing and removing of such objectionable material to be done and measured only where the Engineer and Supervisor shall order. The same to be paid for by the acre for the land actually grubbed at prices named in the accepted bid.

CARTING GRAVEL.

21. The contractor will not be required to cart any gravel a greater distance than one-half ($\frac{1}{2}$) mile without extra pay, for each extra half mile of carting or fraction thereof, at a price per cubic yard named in his accepted bid.

22. All gravel used for surfacing found within one-half ($\frac{1}{2}$) mile of the place where it is to be used, whether on the line of the road or not, must be carted without extra pay.

23. On certain sections of the road, when the gravel is found just where it is wanted, and does not require (in the judgment of the Engineer) to be loaded and carted, no allowance will be made for the same, other than the price per lineal foot accepted for "The Preparation of the Road-bed," and no other pay for the graveling, rolling or placing the same will be allowed.

24. If there are sections of this road which do not, in the judgment of the Engineer, require any "Preparation of the Road-bed," but do require a coat of gravel, this shall be applied when ordered by the Engineer in the manner already specified, and to a depth by him to be named, and measured when compact and paid for at same price per cubic yard as other gravel furnished under these specifications.

STRIPPING GRAVEL BEDS.

25. Some of the gravel beds are covered with objectionable surface material which must be first removed by the contractor, and deposited where the Engineer so directs, and to be paid for by the county at a price per cubic yard named in accepted bid for removing or stripping such objectionable material from top surface of gravel bed. No allowance will be made for removing stumps, trees, brush or roots from gravel pit.

SHOULDERING.

26. A shoulder of firm earth or gravel is to be left or made on each side extending at the same grade and curvature of road to side ditches or gutters. This shoulder is to be thoroughly rolled for its entire width on each side of the gravel bed.

OPEN DITCHES.

27. When necessary the side ditches or gutters are to be excavated as per stakes furnished by Engineer, to give an easy flow of water, so that no water shall be left standing on the road or in the ditches, for all of which no extra payment will be made.

UNDER-DRAINS.

28. Under-drains, if found necessary, shall be constructed by the contractor (at prices named in bids) of good four (4) inch sole or pipe tile, laid upon a board of not less than one (1) inch in thickness and six (6) inches in width, whenever and wherever the Engineer shall decide; top of tile to be at least thirty (30) inches deep, unless otherwise directed by the Engineer, the joints of the tile to be covered with salt hay or other suitable hay, and trench filled with pervious earth.

EXTRA DEEP.

29. Should the committee so order, the contractor is to build in all other respects, as already specified, the gravel bed to a greater depth or thickness than that already named. The contractor is to do the same at a price named per square yard for each extra inch in depth.

NO EXTRA PRICE.

30. No allowance in measure of depth of pavement will be made on account of any material which may be driven into the road-bed by rolling. The pavement, when completed, must conform to the grade and cross-section and be satisfactory to the Engineer, whose decision shall be final.

31. No extra work will be paid for unless the price has been agreed upon between the contracting parties, including the State Commissioner of Public Roads, and endorsed upon the agreement, witnessed by the Engineer.

32. When extra depth of pavement is required, it must be obtained by making the pavement thinner on the more solid portions of the road. Changes in depth to be made only upon the written order of Engineer and State Commissioner of Public Roads and as located by them.

33. All clay or gravel for shouldering and all extra hauling to be at the contractor's expense.

BIDS.

34. Bids will be received under these specifications as follows:

(1) Price per lineal foot for the preparation of road-bed.

(2) Price per acre for grubbing and removing objectionable matter from sidewalks.

(3) Price per lineal foot for completed tile drain.

(4) Price per cubic foot for excavating open ditches.

(5) Price per cubic yard for excavations on an average in excess of 12 inches in one continuous cut in preparation of road-bed.

(6) Price per cubic yard for compacted gravel, ——— wide, as specified.

(7) Price per square yard for each ordered inch in depth in excess of thickness named.

(8) Price per cubic yard for carting gravel more than one-half mile and each additional half mile or fraction thereof.

(9) Price per cubic yard for stripping or removing earth from top of gravel bed.

(10) Price (lump) for the whole road complete, according to specifications—plans prepared by the Engineer.

ESTIMATES OF QUANTITIES.

35. (1) Number of lineal feet in preparation of road-bed.
(2) Number of acres that require grubbing.
(3) Number of lineal feet of tile drain.
(4) Number of cubic yards to be excavated from open ditches.
(5) Number of cubic yards in excess of twelve inches.
(6) Number of cubic yards of compacted gravel.
(7) Number of miles for carting in excess of one-half mile.
(8) Number of cubic yards of stripping on gravel bed.
(9) ——— miles completed.
(10) Gravel road at ——— per mile.
(11) Total, ———.

36. These quantities are the result of careful calculation, but are to be considered as approximate. The County will not be responsible for any excess in above quantities, should any occur. The contractor is expected to satisfy himself as to the nature, character and quantity of the labor and material required by a personal examination of the work contemplated.

37. Bids shall be accompanied by approved bond to insure the execution of the agreement, to the amount of at least One Thousand (\$1,000.00) Dollars.

LIABILITIES OF CONTRACTOR.

38. He shall keep up sufficient guards by day and night, to prevent accidents from travel, and will be liable for any damage which may arise by his neglect to do so from any omission on his part.

39. He shall keep the road sprinkled until the final certificate of completion by the Engineer is given.

40. He is to commence and prosecute the work upon the road at such points as may be directed by the Engineer and Supervisor, within ——— days from and after the signing of the contract, and shall continue work thereon until completion, except as herein provided.

41. He further agrees to complete the same on or before the ——— day of ———, A. D. ———. Twenty dollars for each day that the work shall remain uncompleted after the time allowed by contract may be deducted from any moneys due contractor, as liquidated damages. A bonus or premium of \$1.00 per month will be paid the contractor for each month the road is completed before the time specified in the contract, except only to the provisions herein contained, unless otherwise agreed upon by the Board of Freeholders, on certificate of the Engineer recommending the extension of the time limit of completion.

42. The contractor shall keep the finished roadway and earth-work in repair for the space of one year from the date of its completion and acceptance, and shall be liable for wear and tear caused by ordinary travel, and as much longer as for any period or periods during said year it shall be out of proper condition; and if, during that time, the roadway or any part of the work shall, in the judgment of the Engineer and Board of Freeholders, require repairing, and they shall duly notify the contractor to make repairs as required, and if the contractor shall refuse or neglect to do so, to the satisfaction of the said Engineer and Board of Freeholders, within five days from the date of service of notice, then said Engineer and Board of Freeholders shall have the right to have the work done properly by other parties and pay the expense for the same out of the five per cent. retained.

43. The contractor will be required to preserve all stakes and bench-marks made and established on the line of work until duly authorized by the Engineer to remove the same.

44. The contractor shall not disturb the position of title stones (the corners to properties adjacent to road); where they appear he will either lift or lower them so that their tops may conform with the finished surface of the gravel construction under the personal supervision of the Engineer.

45. The contractor must also preserve the roadway on which he is working from needless obstruction, and where necessary will construct safe and commodious crossings, to be maintained in good order, and to afford all proper and reasonable means for the accommodation of the public.

ENGINEER.

46. The Engineer is to be selected or appointed by the Freeholders and paid by them. He is to furnish all surveys, profiles, plans, specifications and quantities of all kinds before specifications are signed, and in such a clear manner that lump bids can be made upon the work. He is to place stakes at small intervals on opposite sides of the road, marked for the finished grade, so that by line and rule the depth of pavement can be easily and correctly determined. He is also to furnish estimates of quantities of work done before partial payments are made, the quantity of road laid to be determined by surface measurement, and should any difference arise between the contracting parties as to their meanings, his decisions on these matters are to be final and conclusive. The work is to be done according to his direction, and if any material is brought upon the road not approved by him it is to be removed at the expense of the contractor.

RIGHT TO BUILD BRIDGES, CULVERTS, &C., AND SUSPENSION OF WORK.

47. The right of the county to build bridges, culverts, or lay pipes or other appurtenances in connection therewith in said road, during the progress of the work, is expressly reserved, as well as suspending the work or any part thereof during the construction of the same for the purpose above stated, without further compensation to the contractor for such suspension than an extension of time for completing the work as much as it may have been delayed by such suspension.

STOPPING WORK ON ACCOUNT OF WEATHER.

48. The Supervisor, in his discretion, may stop any portion of the work if, in his judgment, the weather is such as to prevent the same being done properly. No allowance of any kind will be made for such stoppage, except an extension of the time for the completion of the work as herein provided for.

ABANDONMENT OF CONTRACT.

49. If at any time the work under contract should be abandoned, or if at any time the Supervisor or Engineer should judge and so certify in writing that said work or any part thereof is unnecessarily delayed, or that the contractor is wilfully violating any of the conditions or covenants of this contract, or is executing the same in bad faith, the Board shall thereupon notify the said contractor to discontinue all work under this contract, and may employ other parties to complete the work in such manner as they may decide, and use such material as they may find upon the line of said work, and to procure other material for its completion, and charge the expense of the said labor and material to the contractor, to be deducted from any moneys due him under contract, and in case such expenses shall exceed the sum which would have been payable under contract, if the same had been completed by said contractor, he or his bondsmen shall pay the amount of the excess to the Board of Freeholders, on notice from the Engineer.

SUPERVISOR.

50. Nothing in these specifications, relating to the duties of the Engineer, shall be taken or construed to in any manner conflict with the duties of the Supervisor in the performance of his duties, as specifically set forth in the act entitled "An act to provide for the more permanent improvement of the public roads of this State," approved March 22d, 1895, and the supplements thereto, but they shall co-operate as far as practicable. The con-

tractor shall employ competent men to do the work, and, whenever the Supervisor shall inform him in writing that any man on the work is unfitted for the place, or is working contrary to the provisions of the specifications or the instructions of the Engineer, he shall thereupon be discharged.

INSPECTION.

51. All directions and determinations, necessary to give due and full effect to any of the provisions of these specifications, shall be given by the Engineer and Supervisor.

52. All material and workmanship of any kind shall be subject at all times to the inspection of the Engineer and Supervisor. Whenever unfaithful and imperfect work is discovered it shall be repaired or replaced by the contractor, after due notification from the Engineer and Supervisor.

SUB-LETTING OF CONTRACT.

53. The contractor shall not assign or sub-let any portion of this contract without the consent of the Board of Freeholders and the State Commissioner of Public Roads.

PAYMENTS.

54. Monthly payments will be made by the Board of Freeholders to the contractor, if desired, for all completed work, upon presentation by him of the proper certificates of the Engineer and Supervisor to the extent of eighty per cent. of the amount then due. Fifteen per cent. will be paid at the completion of the work. The balance (five per cent.) will be retained by the said Board of Freeholders to keep the roadway completed by the contractor in good repair, in case said contractor fails to do so, during the period of one year, after the expiration of which time and the final release of the contractor the said balance of five per cent., or such portion of it as has not been expended as aforesaid, will be paid over to the contractor.

BOND OF CONTRACTOR.

55. The contractor will be required to execute, within five days after giving of contract, a bond in such sum and with such securities, and not less than fifty per cent. of the cost of the road when completed, as shall be approved by the Board of Freeholders or its committee, conditioned for the faithful performance of the contracts and to indemnify and save harmless the parties of the said Board of Freeholders or its committee from all suits or actions of any name or description brought against them for or on account of any injuries or damages received or sustained by any party or parties, by or from the said contractor, his servants or agents, in the construction of said work, or by or in consequence of any negligence in guarding the same, or any improper material used in its construction, or by or on account of any act or omission of the contractor or his agents, and for the faithful performance of the contract by the contractor, and the said contractor hereby further agrees that so much of the money due him under and by virtue of this agreement, as shall be considered necessary by the Board of Freeholders or its committee, may be retained by the said Board of Freeholders or its committee until all such suits or claims for damages aforesaid shall have been settled, and evidence to that effect furnished to the satisfaction of the said Board of Freeholders or its committee.

CONTRACTOR TO INSURE PAYMENT FOR LABOR, MATERIAL, &C., ON
FINAL ESTIMATE.

56. The contractor must also furnish said Engineer and Supervisor with satisfactory evidence that all persons who did work or furnished material for this contract, or who have sustained damage or injury by reason of any act, omission or carelessness on his part or his agents, in the prosecution of the work, have been fully paid and secured; and shall also give notice to said Engineer and Supervisor within ten (10) days after the completion of the work, that any balance of such work or materials, or compensation for such damage still due, has been fully paid or released.

PERSONAL ATTENTION.

57. The contractor must give his personal attention to the work and not assign or sub-let the same, but keep the same under his control.

_____,
City Engineer.

_____,
_____,
_____,
_____,
_____,

Road Committee.

Approved this _____, A. D. _____, by resolution of the Board of Chosen Freeholders.

_____,
Director Board of Chosen Freeholders.

_____,
Clerk of Board of Chosen Freeholders.

OFFICE STATE COMMISSIONER OF PUBLIC ROADS,
TRENTON, N. J.

I have this day carefully read and examined the foregoing specifications, and the same are hereby approved.

Any departure from these specifications which increases the cost of the road must have the written consent of the State Commissioner of Public Roads.

Given under my hand, this _____, A. D. _____.

_____,
State Commissioner of Public Roads.

APPENDIX B.

Following is the text of the State Aid Road law, with its amendments:

CHAPTER CCXXIII.

An Act to provide for the permanent improvement of public roads of this State.

I. BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey*, That whenever the board of chosen freeholders of any county in this state shall, by resolution, have declared their intention to cause any particular road, or section thereof, within such county, to be improved under the provisions of this act, such board shall cause all necessary surveys to be made and specifications to be prepared; the specifications shall require the construction of a macadamized road, or a telford or other stone road, or a road constructed of gravel, oyster shells or other good materials, in such manner that the same, of whatever materials constructed, will, with reasonable repairs thereto, at all seasons of the year, be firm, smooth and convenient for travel; shall be so prepared as to call for bids from which an approximate estimate of the cost can be ascertained, and shall state the amount of security that will be required of the bidder; after said specifications shall have been prepared they shall be submitted to the board of chosen freeholders for their approval or rejection; and if such board shall approve them, they shall then be submitted to the state commissioner of public roads for his approval or rejection; it shall be the duty of the commissioner of public roads, before approving

Board of freeholders may cause road to be improved.

What specifications require.

How prepared.

Freeholders to reject or approve.

Commissioner
to examine
road and ap-
prove specifica-
tions.

Cost of all roads
not to exceed
3 1/2 per cent.

May withhold
his approval.

Distribute
among the
counties.

When ap-
proved, free-
holders must
advertise for
bids.

the specifications of any road so submitted to him, to ascertain, by personal examination or otherwise, the natural character of the soil upon which such road is proposed to be constructed, and all other facts that he may deem important, and if, after examination of the specifications and facts so ascertained, he shall be of the opinion that the specifications provide for the construction of a road that will, with reasonable repairs thereto, be firm, smooth and convenient for travel at all seasons of the year, and if he shall also be of the opinion that one-third of the cost of constructing the road or section of road to which such specifications relate, together with one-third of the cost of constructing all other roads and sections of roads in this State under specifications previously approved by him, will not in any one year exceed the sum of one hundred thousand dollars, then he shall approve the specifications, but otherwise he shall reject them; *provided, however,* that he shall, in his discretion, have the power to withhold his approval of any specifications, to the end that the estimated aggregate amount of contracts made in any one year shall not exceed the sum of three hundred thousand dollars, and also to the end that the amounts paid out of the state treasury under the provisions of this act shall in each year be distributed amongst the several counties of the state in such manner as to the said state commissioner of public roads shall seem fair and equitable, and any specifications, the approval of which is withheld as aforesaid, may, if otherwise satisfactory to the said state commissioner of public roads, be approved by him in any year subsequent to the one in which the same may be presented for approval as aforesaid; if the board of chosen freeholders and the state commissioner of public roads shall both approve such specifications, it shall then be the duty of the director of the board of chosen freeholders to advertise in at least two daily newspapers, printed and circulating in the county, for the period of two weeks, or in at

least two weekly newspapers, printed and circulating therein, for at least four weeks, for bids to do the work according to the specifications prepared; such advertisements shall state where bidders may find the specifications, and shall name a time and place where the board of chosen freeholders, or a committee of five members thereof, of whom the director shall be one, will meet to receive bids; every such bid shall be accompanied with the bidder's bond in the sum of one thousand dollars, with security satisfactory to the board, conditioned that if the contract shall be awarded to him he will, when required by the board, execute an agreement in writing to perform the work according to the specifications; no bids shall be received by the board or any member thereof, or by said committee or any member thereof, except at a meeting of said board or committee, of which notice shall be given as aforesaid, and all bids then received shall be immediately publicly read; if the bids shall be received by a committee of the board they shall be reported to the board at the next meeting thereof, with the recommendations of the committee; the board may reject all bids if, in their opinion, good cause exists therefor, but otherwise they shall award the contract to the lowest bidder who shall give satisfactory evidence of his ability to perform the contract; *provided, however*, that the estimated amount of contracts awarded in any one year by any board of chosen freeholders, together with the estimated cost of repairs of roads already constructed, shall not exceed one-fourth of one per centum of the ratables of the county as reported to the State comptroller for the last preceding year; *and provided further*, that in every contract made as aforesaid it shall be specified that at least five per centum of the contract price shall not be paid to the contractor within the period of one year after the work specified to be done by such contract shall have been fully performed and accepted; the bidder to whom the contract may be awarded shall, in addition to execut-

Committee to
receive bids.

Bidders must
give bond.

Bids, how
received.

Limit of county
expenditures.

Five per
centum to be
retained by
county.

Contractors
must give
bond.

Copy of contract and specifications filed with state commissioner.

Commissioner must appoint supervisor.

Property-owners nominate supervisor.

Commissioner may remove supervisor.

ing the agreement to perform the work according to the specifications, also execute to the board of chosen freeholders a bond conditioned for the faithful performance of the contract, in the sum specified in the advertisement for bids, and with such sureties as the board may approve; the contract shall, on behalf of the board of chosen freeholders, be executed by the director thereof, and, when executed by the bidder and said director, a copy of the contract and specifications, with the estimated cost of the work, shall be forthwith filed with the state commissioner of public roads.

2. *And be it enacted*, That after a copy of the contracts and specifications shall have been filed with the state commissioner of public roads as aforesaid, the said state commissioner of public roads shall, as soon as practicable, appoint a supervisor of the construction of the work under such contract, who shall receive for his services under this act three dollars per day, to be paid out of the county treasury; if the work for which such contract shall be made shall have been petitioned for pursuant to the provisions of the eighth section of this act, then, if the petitioners therefor, or any of them, shall in writing nominate to the said state commissioner of public roads one or more persons for the position of such supervisor, it shall be the duty of said state commissioner of public roads, if only one nomination be made, to appoint as such supervisor the person so nominated, and, if more than one nomination be made, to appoint as such supervisor one of the persons so nominated, and if no such nomination be made, the said state commissioner of public roads shall then appoint as such supervisor any person whom he may consider competent for such position; the said state commissioner may, however, at any time summarily discharge any supervisor who, in the judgment of the state commissioner, is incompetent or who neglects his duty, and, in such case, shall appoint a new supervisor to take the place of the one so discharged; the supervisor shall supervise all work done

under the contract, shall give his whole time thereto, shall require the provisions of the contract to be strictly adhered to by the contractor, and, in any case where the contract provides for partial payments during the progress of the work, he shall also, as each payment becomes due, and before payment shall be made, present to the board his certificate, and also the certificate of the surveyor or engineer, if any there be, stating as near as may be the total amount of work done, and that such work has been done in all respects as required by the contract; and the board shall thereupon direct payment to be made by the county collector; *provided*, that no partial payment made during the progress of the work shall exceed eighty per centum of the estimated value of the work done; the board shall have power to borrow on temporary loans on the credit of the county such sums of money for the purpose of carrying on such work as may from time to time become necessary; and when the work shall have been fully completed, and the terms and conditions of the contract shall have been fully complied with, and such facts shall have been certified to the board to their satisfaction by the supervisor and the surveyor or engineer, if any there be, payment in full shall be made, less the amount required to be withheld for the period of at least one year, as in the next preceding section specified.

Supervisor
must give his
full time to
the work.

Supervisor
must certify
payments.

Freeholders
may borrow
money tempo-
rarily.

3. *And be it enacted*, That when the work under any contract shall have been fully completed, it shall be the duty of the supervisor to prepare a detailed and itemized statement in duplicate of the cost of the improvement, one copy whereof shall be filed with the board of chosen freeholders and one with the state commissioner of public roads.

Supervisor to
prepare final
certificate.

4. *And be it enacted*, That one-third of the cost of all roads constructed in this state under this act shall be paid for out of the state treasury; *provided*, that the amount so paid shall not in any one year exceed the sum of one

State to pay
one-third cost.

Total state
appropriation.

hundred thousand dollars; if one-third of such cost shall appear by the statements filed in any one year with the state commissioner of public roads to exceed the said sum of one hundred thousand dollars, then,, and in such event, the said sum of one hundred thousand dollars shall be apportioned by the governor and state commissioner of public roads amongst the counties of the state in proportion to the cost of roads constructed therein for such year, as shown by the statements of costs filed in the office of the state commissioner of public roads; the governor and said state commissioner of public roads shall, between December fifteenth and thirty-first in each year, certify to the state comptroller the amount to be paid to each county for such year, and the state comptroller shall thereupon draw his warrants in favor of the respective county collectors for the sums certified as aforesaid upon the state treasurer, who shall pay the same out of any moneys in the state treasury not otherwise appropriated.

Allotment to
be made before
December 31st.

Comptroller to
draw warrants.

Board of free-
holders to
certify cost to
assessors.

5. *And be it enacted*, That on or before September first in each and every year it shall be the duty of the board of chosen freeholders to certify to the county board of assessors, either in the annual tax budget or separately, two-thirds of the estimated cost of all work for which contracts shall have been awarded under this act during such year; and the county board of assessors shall include the sum so certified in the county taxes assessed for such year, and the same shall be assessed, collected and paid over to the county in the same manner and within the same time that other county taxes are assessed, collected and paid over; if a deficiency shall exist in consequence of the cost exceeding the estimate, or in consequence of the receipt of less than one-third of the cost from the state treasury, the board of chosen freeholders shall have authority to borrow on temporary loans to the amount of such deficiency until the next annual taxes shall be assessed, collected and paid over to the county; and if there be a surplus, in consequence of the cost being less than

Deficiency,
how met.

the estimate, such surplus shall be retained and used in the construction of other roads under this act, or in repairs to roads constructed under this act.

6. *And be it enacted*, That instead of certifying to the county board of assessors two-thirds of the estimated cost of all work for which contracts shall have been awarded under this act in any one year as required by the fifth section of this act, or two-thirds of said estimated cost less one-tenth of said estimated cost as required by the eighth section of this act, the said board of chosen freeholders may, if a resolution to such effect shall be adopted by a vote of at least two-thirds of all its members, borrow such sum or sums of money as may be necessary for the payment of such proportion of said estimated cost by the sale of the bonds of such county, issued in the name of the board of chosen freeholders thereof, and in such sums as the said board may deem proper; said bonds shall bear interest at a rate not exceeding five per centum per annum, shall be sold at not less than their par value, shall not exceed in the aggregate the proportion of the estimated cost of such roads as hereinabove mentioned, shall be so divided that one-tenth of the amount of the proportion of said estimated cost shall fall due in one year from their date, and one-tenth of the proportion of said estimated cost in each successive year thereafter for the period of ten years after their date, and shall be either coupon or registered bonds, as the board of chosen freeholders may determine; the principal and interest thereof may be made payable at the office of the county collector of such county; said bonds shall be signed by the director of said board and the county collector, and shall be sealed with the seal of the county, and the county collector shall keep a record thereof; it shall be the duty of the board of chosen freeholders each year to place in the tax levy for such county in each year, so long as said bonds shall run, a sufficient sum to pay the interest accruing thereon for

Two-thirds less one tenth.

Bonds, how sold.

When to mature.

Record to be kept.

said year and the principal of the bonds that shall mature in said year.

County road,
township rights
acquired.

7. *And be it enacted,* That any road constructed under the provisions of this act, except within the limits of any city, shall forever thereafter be a county road, and the duty of keeping the same in repair, except within the limits of any city, shall devolve upon the board of chosen freeholders and the county supervisor hereinafter mentioned, and all other powers and duties respecting such roads, except within the limits of any city, shall be imposed upon and vested in the said board of chosen freeholders, to the exclusion of all township, borough or other municipal officers excepting city officers; after the first road shall have been constructed under this act in any county, it shall be the duty of the board of chosen freeholders thereof to appoint a county supervisor of roads, who shall hold his office for three years and until his successor is appointed, shall give bond to the board of chosen freeholders in the sum of one thousand dollars conditioned for the faithful performance of the duties of his office, with such sureties as the board may approve, and shall receive such salary or allowance as the board may fix; the board of chosen freeholders shall provide all moneys necessary to keep in a proper state of repair the roads constructed under this act, except within the limits of any city, and may, if there be no moneys on hand that can be lawfully used for such repairs, borrow therefor on temporary loans until the next annual taxes shall have been assessed, collected and paid over to the county; it shall be the duty of the supervisor to report to the board of chosen freeholders, or to the road committee thereof, all repairs he may think necessary or proper to be made to such county roads, and under the direction and control of the said board of freeholders or its road committee, to expend moneys raised for such repairs in such manner and upon such portions of the roads as will tend to keep them in the best possible state of repair; no part of said moneys.

County super-
visor, when
appointed.

Compensation
to be fixed.

Duties of.

County to bor-
row by tempo-
rary loans.

Money, how
expended.

shall be paid into the hands of the supervisor, but all ex-
 penses of repairs shall be paid by the county collector on
 the orders of the board of chosen freeholders, granted
 only on the presentation of bills verified by affidavit, as
 now required by law in the case of other claims against
 the county; if the board of chosen freeholders shall neglect
 or refuse to make appropriations sufficient to keep any
 such road as aforesaid in good repair, any citizen of the
 county may apply to the supreme court for a writ of
 mandamus to compel said board to make an appropria-
 tion as aforesaid; and when any such application is made,
 the court, upon a rule to show cause or otherwise, in such
 manner as the court shall prescribe, shall ascertain and
 determine whether such road as aforesaid is in a proper
 state of repair, and may also, in its discretion, allow to
 the attorney of the applicant a reasonable counsel fee to
 be paid by the county; in case the board of chosen free-
 holders shall not have on hand sufficient moneys out of
 which to make the appropriation commanded to be made
 by any writ of mandamus granted as aforesaid, they shall
 borrow such sum or sums as may be necessary therefor
 on temporary loans on the credit of the county, and shall
 require the amount so borrowed to be raised by taxation
 with the next assessment of county taxes; it shall be the
 duty of the authorities of any city within which any por-
 tion of road may be constructed under the provisions of
 this act to keep the portion thereof within such city in
 repair forever after such construction, and such city shall
 have the same power, authority and jurisdiction over such
 portion of such road, and shall have imposed upon it the
 same duties as were imposed upon and vested in it with
 respect to such portion of such road before its improve-
 ment under the provisions of this act.

County col-
lector to make
all payments.

Neglect to
repair.

Freeholders
to be man-
damused.

Portion of road
within city
limits to be
kept in repair
by the city.

8. *And be it enacted*, That whenever there shall be pre-
 sented to the board of chosen freeholders of any county a
 petition signed by the owners of at least two-thirds, either
 in lineal feet or area, of the lands and real estate fronting

Petition, how
signed.

Lineal feet or
area.

or bordering on any public road or section of road in such county, taking in said estimate of area all the lands of every such owner which are assessed for taxes in said county and which lie together in any farm, tract or lot of which a part has a frontage on said road or section of road, praying the board to cause such road or section to be improved under this act, and setting forth that they are willing that the peculiar benefits conferred on the lands fronting or bordering on said road or section shall be assessed thereon in proportion to the benefits conferred to an amount not exceeding ten per centum of the entire cost of the improvement, it shall be the duty of the board to cause such improvement to be made; provided, that the road or section desired to be so improved shall be at least one mile in length, or, if it be less than one mile in length, shall be an extension or for connection with some other permanently improved or paved road or street; *and provided, further*, that the estimated cost of all improvements made under this act, together with the estimated cost of repairs of roads already constructed in any county in any one year shall not exceed one-fourth of one per centum of the ratables of such county for the last preceding year; *and provided, further*, that where more roads are applied for than can be constructed under this act in any one year, the said boards of chosen freeholders shall have the power and authority to select from the roads petitioned for the ones first to be constructed, having regard to the most important roads and the distribution of the benefits of this act to all parts of their counties; it shall not be necessary for the board in any such case to declare by resolution their intention to cause such improvement to be made, but they shall forthwith cause all necessary surveys of such road or section to be made, and specifications to be prepared for a macadamized road, or a telford or other stone road, or a road constructed of gravel, oyster shells or other good material, in such manner that the same, of

Length of road.

If less than one mile.

Estimated cost not to exceed one-fourth of one per centum of ratables.

Board of freeholders to select road under certain circumstances.

Must cause surveys to be made and specifications prepared.

Stone or other good material to be used.

whatever materials constructed, will, with reasonable repairs thereto, at all seasons of the year, be firm, smooth and convenient for travel; the proceedings shall thereafter be the same as is hereinbefore required in cases where such intention has been declared; if the specifications shall not be approved by the board or by the state commissioner of public roads, or if all the bids for the work shall be rejected, it shall be the duty of the board to cause other specifications to be prepared, or re-advertisements for bids to be made, as often as may be necessary and until a contract shall be awarded, to the end that the improvement prayed for may be completed with reasonable speed; *provided, however*, that no re-advertisement need be made where the lowest bid submitted shows that the improvement prayed for cannot be made within the limit of expenditure in this section above mentioned; in every case where a contract shall be awarded after the presentation of such petition as aforesaid, the board of chosen freeholders, instead of certifying to the county board of assessors two-thirds of the estimated cost of the work, as prescribed by the fifth section of this act, shall, unless they determine to issue bonds in the manner prescribed by the sixth section of this act, which they are hereby authorized to do, certify two-thirds of said estimated cost, less one-tenth of said estimated cost, which sum the county board of assessors shall include in their assessments of county taxes.

9. *And be it enacted*, That when the improvement prayed for as aforesaid shall have been completed and the statement of the cost thereof filed with the board of chosen freeholders, as prescribed by the third section of this act, said board shall apply to the circuit court of the county for the appointment of commissioners to estimate and assess the peculiar benefits conferred by such improvement upon the lands and real estate fronting or bordering on the road or section thereof improved, of the time and place of which application notice shall be given by

When specifications are not approved or bids rejected.

Other specifications to be made.

No re-advertisement necessary.

After contract awarded, board to certify two-thirds estimated cost, less one-tenth, to assessors.

Commissioners to estimate benefits, how appointed.

To give notice of appointment of.

Court to
appoint and
remove com-
missioners.

Compensation
of.

Oath of com-
missioners.

Commissioners
to give public
hearing of time
of meeting.

ten days' publication in two daily newspapers printed and circulating in the county, or by two weeks' publication in two weekly newspapers printed and circulating therein, at which time and place, or at such other time and place as the court shall designate, said court shall, without unnecessary delay, appoint three commissioners, who shall be disinterested freeholders and residents of the county in which the application is made, to estimate and assess the benefits aforesaid; the said court shall have power to remove any commissioner and appoint another in his place and also to fill any vacancy that may occur in the office of any commissioner from any cause; said commissioners shall each receive three dollars per day, to be paid by the county collector.

10. *And be it enacted*, That said commissioners, before entering upon the duties required of them by this act, shall take and prescribe before some person duly authorized to administer the same an oath or affirmation that they will make all assessments and estimates required of them fairly, legally and equitably, according to the best of their skill and understanding, which oath or affirmation shall be attached to the report that they are hereinafter required to make.

11. *And be it enacted*, That the said commissioners, having thus qualified, shall give such notice as the court may direct of the time and place when and where they will hear any persons in interest who may present themselves to be heard, and at such time and place and at such other times and places to which they may adjourn for that purpose the said commissioners shall attend, and shall give a public hearing to those persons in interest who may desire to be heard; the said commissioners shall have power to examine witnesses under oath or affirmation, to be administered by any one of them, and to enter upon and view the lands and real estate fronting or bordering on the road or section thereof improved, and to adjourn from time to time in their discretion, or as directed by

said court; they shall use diligent efforts to ascertain the names of the owners of the lands fronting or bordering on the road or section thereof improved, and shall state the same in the report hereinafter mentioned; but the failure to ascertain the name of any owner, or to state the same correctly, or the omission of any such name from the report, shall not invalidate said assessment nor be a bar to the collection of the same.

12. *And be it enacted*, That after having given opportunity as aforesaid for a public hearing of the persons in interest, and having viewed the lands fronting or bordering on the road or section thereof improved as aforesaid, the said commissioners shall make a report in writing of their estimates and assessments to the said court, accompanied by a map prepared by the engineer in charge of the construction of the road, showing the several tracts or parcels of land and real estate fronting or bordering on said road or section thereof; the said report shall state the cost of the whole work, which shall be furnished to the commissioners by the board of chosen freeholders from the report of the supervisor of construction filed with said board under the requirement of the third section of this act, and shall give the names, so far as ascertained, of the owners of the tracts or parcels of lands and real estate fronting or bordering on said road or section thereof, the city, township, borough or other municipality in which each tract or parcel of lands is situate, and the amount of the assessment upon the owner or owners of each of said tracts or parcels of lands and real estate for the said benefits; which several assessments shall be in proportion, as near as may be, to the peculiar benefits deemed to have been conferred by said improvement upon the respective tracts of lands and real estate aforesaid; if any tract of land shall be located in more than one city, township, borough or other municipality, it shall be stated in said report as being in the city, township, borough or other municipality, in which there

Commissioners
to report in
writing.

Map made by
engineer in
charge of the
road.

Names of prop-
erty-owners
required.

Location of
tracts of land.

is the greatest frontage by lineal feet on the road or section thereof improved; in no case shall any tract of parcel of land and real estate, or any owner thereof, be assessed beyond the amount of benefit actually derived from said improvement, nor shall the aggregate amount of assessments imposed upon the tracts or parcels of land fronting or bordering on such road or section thereof exceed ten per centum of the total cost of the improvement.

13. *And be it enacted*, That upon the coming in of any such report signed by the said commissioners, or any two of them, said court shall cause such notice to be given as it shall deem proper of the time and place of hearing any objections that may be made to such assessment, and after hearing any matter that may be alleged against the same the said court, either by rule or order, shall confirm the said report, or shall refer the same to the same commissioners for revision and correction, or to new commissioners to be appointed by the said court forthwith to reconsider the subject-matter thereof, and the said commissioners to whom such report shall be so referred by the court shall return the same corrected and revised, or a new report to be made by them in the premises, to the said court, without unnecessary delay, and the same, being so returned, shall be confirmed, or again referred by the said court in the manner aforesaid, as right and justice shall require, and so, from time to time, until a report shall be made or returned in the premises which said court shall confirm; such report, when so confirmed, shall be final and conclusive, as well upon the said boards of chosen freeholders and the cities, townships, boroughs or other municipalities in which said lands may be situate, as upon the owners of any lands and real estate affected thereby, and the court shall require the same to be forthwith filed with the county clerk, and certified copies thereof and of the accompanying map, and of the rule or order confirming the report, to be promptly delivered to the county collector, one for said county collector and

Court to give
notice of
hearing.

Court may
order new
report.

When report is
confirmed shall
be final and
conclusive.

File with
county clerk.
Copies to
county col-
lector and
townships, &c.

for each city, township, borough or other municipality in which the assessed lands may lie; the county collector shall retain one of the said copies for his own use, and shall forthwith give one to the collector or receiver of taxes in each of the cities, townships, boroughs and other municipalities in which the assessed lands may lie; each city, township, borough or other municipality whose collector or receiver of taxes shall receive such certified copy shall, by its proper disbursing officer, within six months after the date of the said order of confirmation, pay the amount of assessments appearing by said report to have been assessed upon the lands situate in such city, township, borough or other municipality, who shall receive for his services three per centum of the money so collected, to be paid by the county.

Township to collect in six months.

14. *And be it enacted*, That no certiorari shall be allowed by any court to review any of the proceedings in relation to such improvement, nor in any way to affect any assessment made by such commissioners, after the lapse of thirty days from the making of the order of the court confirming such assessment; the court shall designate what notice, if any, shall be given by the publication or otherwise of the confirmation of the report of said commissioners.

No certiorari allowed.

15. *And be it enacted*, That the assessments made by said commissioners shall be and remain a lien upon the lands assessed from the date of the confirmation of the report of assessments in the same manner and to the same extent that taxes are liens upon lots or tracts of land situate in the city, township, borough or other municipality in which the assessed lands may be.

Assessments to remain a lien on the property.

16. *And be it enacted*, That the receiver or collector of said city, township, borough or other municipality shall, as soon as the said report is delivered to him, give to the owners of lots and tracts of lands appearing by said report to be assessed, such notice of the assessments and of the time within which the same are required to be paid, as the

Collector to notify owners of lands.

court in its order of confirmation, hereinabove mentioned, shall prescribe; all such assessments shall become due and payable to such receiver or collector within six months from the date of the order of confirmation hereinabove mentioned.

Township, &c.,
to bring suits
for collection of
assessments.

17. *And be it enacted*, That if any assessment upon any lot or tract of land made under the provisions of this act shall not be paid within the time appointed in said notice, the township committee, common council or other governing body of the city, township, borough or other municipality within which such lot or tract of land shall be situate, or a majority of them, may, as they shall deem proper, either bring an action on contract in any court of competent jurisdiction, in the corporate name of such city, township, borough, or other municipality, against the owner or owners of such lot or tract of land for so much money laid out and expended by them for the use of such owner or owners and declare generally, and give the special matter in evidence, and either party from any judgment rendered therein may have the same remedy by appeal or otherwise as if said parties were private individuals, or they may proceed to collect the said assessment by sale of the lot or tract of land whereon such assessment has been imposed, or may be a lien; in the same manner and to the same extent as lands are now sold for unpaid taxes in such city, township, borough or other municipality, and the purchaser or purchasers at any such sale or sales, and his legal representatives shall hold and enjoy such lot or tract of land, with the rents, issues and profits thereof, in the same manner and by the same title and tenure as purchasers at the sales of lots or tracts of land for unpaid taxes can now hold and enjoy the same in such city, township, borough or other municipality.

Either party
may appeal.

Assessments to
be a lien upon
the lands and
sold as lands
are now sold
for taxes.

Property-own-
ers may im-
prove at their
own expense.

18. *And be it enacted*, That any property owners or owner along any road in any county of this state which has not been improved, or is not undergoing improve-

ment, under the previous sections of this act, shall desire any section of any road in such county to be improved, and are or is willing to contribute the whole expense of such improvement, the supervisor of roads of such county shall, upon the written request of such owners or owner, make a plan of such section of road so to be improved, in which shall be given the levels and distances, and also specifications, which shall state the materials that may be used, and the manner of using them; and a copy of such plan, specifications and of any bids to do such work shall then be submitted by such owners or owner to the board of chosen freeholders, and if such board shall approve them, it shall then be lawful for such owners or owner to accept any bid or bids so approved from among the bidders, and then proceed to build such section of road according to such plan and specifications, and such owners or owner shall have control of the expenditure of the moneys used to make such improvement, subject to the approval and supervision of the supervisor of such county; and upon the completion of the improvement to the satisfaction of the said supervisor and said board of chosen freeholders, and upon the submission to said board of receipts, showing full payment for materials furnished and work done under the plan and specifications, such section of road so improved shall thereafter be a county road; and the said supervisor shall be paid by the aforesaid owners or owner the sum of ten dollars for making the plan, the sum of five dollars for drawing the specifications, and the sum of five dollars for the supervision of the work, and in case such supervisor is not a civil engineer and an actual survey is necessary, then such owners or owner, at their or his expense, shall procure a survey, which shall be subject to the approval of such supervisor, which survey shall take the place of the plan before mentioned.

Bids and specifications received.

Owners to disburse the money.

Shall be a county road. Fees allowed.

19. *And be it enacted*, That the act entitled "An act to provide for the more permanent improvement of the pub-

General repealer.

Proviso.

lic roads of this state," approved the fourteenth day of April, one thousand eight hundred and ninety-two, and all acts supplementary thereto and amendatory thereof, be and the same are hereby repealed; *provided, however,* that this section shall not cause any proceedings for the improvement of any public road or section thereof under the provisions of the act hereby repealed to abate, but such proceedings may be continued under the provisions of this act in the same manner as if they had been commenced hereunder.

20. *And be it enacted,* That this act shall take effect immediately.

Approved March 22, 1895.

CHAPTER 43.

ACT TO INCREASE APPROPRIATIONS.

A Further Supplement to "An act to provide for the permanent improvement of public roads in this state," approved March twenty-second, one thousand eight hundred and ninety-five.

BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey:*

Appropriation
for public roads.

1. The sum of one hundred and fifty thousand dollars be and the same is hereby appropriated annually, or so much thereof as may be included in the annual appropriation law, to be paid out of any moneys in the state treasury not otherwise appropriated, for the extension of the benefits and making effective the provisions of the act to which this act is a supplement.

2. This act shall take effect immediately.

Approved March 17, 1899.

CHAPTER 44.

STATE AID TO TOWNSHIPS.

Supplement to an act entitled "An act to provide for the permanent improvement of public roads in this State," approved March twenty-second, one thousand eight hundred and ninety-five.

BE IT ENACTED by the Senate and General Assembly of the State of New Jersey:

I. Whenever there shall be presented to the township committee, borough council, board of trustees or commissioners, or other governing body of any township, town, borough, village, or of any municipality governed by a board of commissioners, a petition signed by the owners of at least two-thirds in lineal feet of the lands fronting on any public road or section of road in such township, town, borough, village or municipality, praying such governing body to cause such roads or section to be improved under the act to which this is a supplement, and setting forth that they are willing that the peculiar benefits conferred on the lands fronting on said roads or section shall be assessed thereon, in proportion to the benefits conferred, to an amount not exceeding ten per centum of the entire cost of the improvement, it shall be the duty of such governing body to consider and determine whether the road or section mentioned in such petition is of sufficient general importance to warrant the expenditure necessary for the improvement thereof, and to grant the prayer of such petition or refuse the same if of opinion that the improvement is not of sufficient public importance, or that the expense thereof will be an unnecessary public burden; and in case the prayer of such petition is granted, then such road shall be improved in the same manner and subject to the same regulations, as far as practicable, as in case where a petition is presented to the

When property may be assessed not to exceed 10 per cent. for road benefits.

board of freeholders of any county under the eighth section of the act to which this is a supplement.

Construction of
road; super-
vision.

2. The said governing body shall cause all necessary surveys to be made, and specifications to be prepared for a macadamized road, or a telford or other stone road, or a road constructed of gravel, oyster shells or other good material, in such manner that the same will, with reasonable repairs thereto, at all seasons of the year, be firm, smooth and convenient for travel, and shall thereafter proceed in the same manner as the board of freeholders is required to proceed by the act to which this is a supplement; and the state commissioner of public roads shall have the same power and authority in respect to the roads authorized by this supplement as by said act are conferred upon him in respect to roads improved under such act.

Supervisor of
construction.

3. The state commissioner of public roads shall appoint as supervisor of the work, such person as shall be nominated by such governing body; such supervisor shall perform the same duties and shall be subject to the same provisions as the supervisor appointed under the act to which this is a supplement, and shall be paid out of the treasury of the township, or other municipality, and shall file one copy of the statement required by the third section of the aforesaid act with the township committee, or other municipal authority, and the other with the state commissioner of public roads.

Proportion of
charges, how
assumed.

4. The aggregate amount of the peculiar benefits conferred on the lands fronting on any road improved under authority of this supplement, not exceeding ten per centum of the entire cost of the improvement, shall be borne by the owners of the land so benefited, one-third of the cost of the improvement (less so much thereof not exceeding one-tenth as shall be assessed upon the property benefited) shall be paid for out of the state treasury; the remaining two-thirds of such cost shall be borne by the said township, or other municipality within which said road is located.

5. The amount of peculiar benefits conferred by such ^{Assessment of benefits.} improvement on lands fronting on such road shall be assessed on the application of the township committee, or other governing body, in the manner prescribed by the act to which this is a supplement, and all proceedings under this supplement shall conform as far as practicable to the proceedings authorized and directed by said act, and the said governing body shall, so far as concerns roads constructed by virtue of this supplement, perform the same duties and have the same powers as by said act devolve upon the board of freeholders in respect to roads built under the aforesaid act.

6. Every road constructed under the provisions of this ^{Maintenance of roads.} supplement shall thereafter be maintained and kept in repair by the township or other municipality in which such road is situate, in the same manner in all respects as other public roads therein are or may be maintained and kept in repair, and none of the special provisions of the act to which this is a supplement, whereby said road shall be a county charge, shall be applicable to roads built by authority of this supplement.

7. This act shall take effect immediately.

Approved March 17, 1899.

Destroying Power to Mandamus.

CHAPTER 168.

A Supplement to an act entitled "An act to provide for the permanent improvement of public roads in this state," approved March twenty-second, one thousand eight hundred and ninety-five.

BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey:*

1. Whenever there shall be presented to the board of chosen freeholders of any county in this state any petition

by the owners of lands praying the said board to cause any road or section thereof to be improved under the provisions of the act to which this is a supplement, it shall be the duty of such board of chosen freeholders, if they are satisfied that all the provisions and conditions of said act have been met and complied with in and by such petitions, to consider and to determine by a vote of a majority of all the members constituting said board, whether the road or section mentioned in said petition is of sufficient general importance to warrant the expenditure of the county and state money for the improvement thereof; and said board of chosen freeholders is hereby authorized, by a vote of a majority of all the members constituting the said board, to grant the prayer of the said petition or to refuse the same if said board shall be of the opinion that the improvement is not of sufficient public importance or that the expense thereof will be an unnecessary public burden; *provided*, that this act shall in no way affect any proceeding heretofore taken to procure a mandamus in case of petition filed under said act.

2. All acts and parts of acts inconsistent with the provisions of this act be and the same are hereby repealed, and this act shall take effect immediately.

Approved April 14, 1896.

Changing Location or Improving.

CHAPTER 75.

An Act to amend an act entitled "An act to provide for the permanent improvement of public roads in this state," approved March twenty-second, one thousand eight hundred and ninety-five.

BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey:*

1. The eighteenth section of the said act shall be amended so as to read as follows:

18. That if any property-owners or owner along any road in any county of this state which has not been improved or is not undergoing improvement under the previous sections of this act shall desire any section of any road in such county to be improved or to be changed in location and improved, and are or is willing to contribute the whole expense of such improvement, and provided every owner of land upon that part of the road proposed to be vacated under this act shall consent in writing to such vacation, the supervisor of roads of such county shall, upon the written request of such owners or owner, make a plan of such sections of roads so to be improved or changed in location and improved, in which will be given the levels and distances, and also specifications stating the materials that may be used and the manner of using them; and a copy of such a plan, location, change of location, specifications and of any bids to do such work shall then be submitted by such owners or owner to the board of chosen freeholders, and if such board shall approve them and any change of location which may be proposed, it shall then be lawful for such owners or owner to accept any bid or bids so approved from among the bidders, or at their own expense to proceed to build such section of road according to such plan, location and specifications, and such owners or owner shall have control of the expenditure of moneys used to make such improvements, subject to the approval and supervision of the supervisor of such county; and upon the completion of the improvement to the satisfaction of the said supervisor and said board of chosen freeholders, and upon the submission to said board of receipts showing full payment for materials furnished and work done under the plan and specifications, such section of road so improved

Property-owners to contribute whole expense of improvement.

Owner to have control of expenditures.

Old road
vacated.

shall, if the board of chosen freeholders shall so declare, thereafter be a county road, but otherwise shall remain an ordinary public highway, and any and all portions of any road now existing which may have been rendered unnecessary or be superseded by the new road so constructed shall be vacated and abandoned as a public road without other action or proceedings than the approval of the board of chosen freeholders as hereinbefore provided; and the said supervisor shall be paid by the aforesaid owners or owner the sum of ten dollars for making the plan, the sum of five dollars for drawing the specifications, and the sum of five dollars for the supervision of the work, and in case such supervisor is not a civil engineer and actual survey is necessary, then such owners or owner, at their or his expense, shall procure a survey, which shall be subject to the approval of such supervisor, which survey shall take the place of the plan before mentioned, and shall include all the new roads proposed to be constructed and all the old roads proposed to be abandoned.

Approved March 23d, 1896.

Increased Power to Borrow.

An Amendment to an act entitled "A supplement to an act entitled 'An act to enable boards of chosen freeholders to acquire, improve and maintain public roads,' " approved March nineteenth, one thousand eight hundred and eighty-nine, which supplement was approved April ninth, one thousand eight hundred and ninety-two.

BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey:*

Section be be
amended.

I. The first section of an act entitled "A supplement to an act entitled 'An act to enable boards of chosen free-

holders to acquire, improve and maintain public roads,' " approved March nineteenth, one thousand eight hundred and eighty-nine, which supplement was approved April ninth, one thousand eight hundred and ninety-two, be amended so as to read as follows :

BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey* :

1. In counties of the second class it shall be lawful to raise a sum not to exceed four hundred thousand dollars, Amount authorized to raise and bonds issued. for which bonds may be issued by the board of chosen freeholders of any such county, under the act to which this is a supplement or any supplement or amendment thereof; *provided, however,* that if work under said act Proviso. and supplements or amendments has already been done to an amount exceeding said sum, bonds under said act and supplements may be issued to an amount sufficient to raise and pay for such work; *and provided also,* that no Proviso. county road bonds shall be issued to such an amount as, in addition to existing debt, shall raise the debt of the county for all purposes above three per centum of the assessed value of the real estate therein; and in case any such bonds shall be issued in excess of the limit aforesaid, all such bonds so issued in excess shall be void in the hands of any person or party notwithstanding any recitals therein or any representations that may be made concerning the same; in case application has already been made to the circuit court and a certificate shall have been recorded and filed, as required by said act, such application need not be repeated in case of any subsequent issue of such bonds where the original certificate on file shows that the new issue of bonds will not exceed three per centum of the assessed value of the real estate in said county as limited by this act.

2. The second section of said act be amended so as to read as follows :

2. In any county of the second class wherein the board of chosen freeholders thereof shall heretofore or may Board not to use money raised except to grade, &c.

Proviso.

hereafter issue bonds under said act and supplements, that such board of such county shall not use any of the money so raised for any other purpose except to grade, macadamize or improve any road in any such county, under the provisions of the act to which this is a supplement and the several supplements and amendments thereof; *provided*, nothing herein shall prohibit the doing of the necessary repair of any road heretofore graded, macadamized or improved by any such board or that may be hereafter graded, macadamized or improved under said act and supplements.

3. All acts and parts of acts inconsistent herewith be and the same are, so far only as they conflict herewith, repealed, and that this act shall take effect immediately.

Approved March 24th, 1897.

CHAPTER 100.

A Supplement to an act entitled "An act to provide for the permanent improvement of public roads in this state," approved March twenty-second, one thousand eight hundred and ninety-five.

BE IT ENACTED by the Senate and General Assembly of the State of New Jersey:

Boundary road or street may be improved.

1. Any road or street, or section of road or street, which constitutes the boundary line between two counties, may be acquired, improved and maintained in manner provided for in the act to which this act is a supplement.

Freeholders of adjoining counties may meet to consider improvements.

2. It shall be lawful for the board of chosen freeholders representing adjoining counties which are divided by any road, street or section of road or street, to jointly meet at such time and such place, in either county, as they may agree upon, to consider and determine the question of acquiring, improving and maintaining said boundary road

or street, or section of road or street, according to the provisions of said act, to the best advantage of the public and the owners of property adjacent thereto; and to that end the said joint board are hereby authorized to prepare maps, plans and specifications, subject to the approval of the commissioner of public roads, for said improvement, which they shall deem necessary and proper for said purposes; the said joint board shall have power to employ a competent engineer or surveyor and such other assistance as they may deem necessary, and upon the completion of said maps, plans and specifications, duplicate copies thereof shall be filed in the office of the clerk of each of the counties affected thereby, and in the office of the commissioner of public roads.

Prepare maps.

Employ engineer.

3. The said joint board may adopt a resolution directing the improvement, as provided for in said act, to be made, and thereupon said joint board shall have full power and authority to enter into contracts with responsible persons for doing the work and furnishing the necessary materials therefor; they shall advertise for proposals in at least two newspapers published in each county, for at least three weeks, and their contracts shall be awarded to and made with the lowest responsible bidder who will comply with the requirements of the joint board and will give ample security for doing the work and performing the contract, but said joint board shall be under no obligation to accept the lowest bid, in which case all other bids will be thrown out and new proposals advertised for in the manner hereinbefore provided.

Make contract.

4. The said joint board shall, on the certificate of the engineer and surveyor, and on such other evidence as they may require as to the work done and materials used and furnished for said improvement, order payments to be made to the contractor or contractors in the manner provided in said act.

Payment.

5. All costs and expenses incurred in the proceedings hereinbefore authorized shall be borne and paid by each

Expenses equally divided.

Maintenance

county in equal proportion, and the said joint board shall, after the completion of the contract and acceptance of the improvement, divide the road into two equal sections, and shall designate the section which each county shall maintain and keep in repair, and therefore each of said counties shall maintain and keep in repair the sections of the road so assigned to it.

Method of transacting business by joint board

6. Said joint board may choose a chairman and secretary and such other officers, and may make such rules for government as shall be deemed advisable; the said joint board shall have power to meet and adjourn from time to time, and as often as in their judgment it shall be deemed necessary to fully carry into effect the provisions of this act; the votes of a majority of the members of the board of each county voting separately shall be necessary to decide any question, order, motion or resolution which may come before the said joint board; the secretary of said joint board and the engineer and supervisor appointed shall receive such compensation for their services as the said joint board shall, as aforesaid, determine to be just and proper; the members of said board shall be entitled to the same compensation as is allowed to them as members of the board of chosen freeholders, and shall comply with the provisions of and receive the benefits from the act to which this is a supplement, as far as the same is consistent and practical.

Compensation

7. This act shall take effect immediately.

Approved March 23d, 1898.

An Act to provide for the acquirement of turnpike roads for free public use.

BE IT ENACTED by the Senate and General Assembly of the State of New Jersey:

Turnpike roads may be acquired for public use.

1. Whenever there shall be presented to the state commissioner of public roads a petition signed by the owners

of at least two-thirds of the land and real estate fronting or bordering on any turnpike road, praying that said road may be acquired for free public use, and setting forth that they are willing that the peculiar benefits conferred on the lands fronting or bordering on said road shall be assessed thereon to an amount not exceeding ten per centum of the entire cost of the said road, then the governor shall appoint five commissioners from the county or counties through which the said road runs; the said commissioners, when appointed, shall take an oath or affirmation faithfully and fairly to perform their duties, and shall thereupon proceed to estimate and determine the fair and just value of the said road, having given ten days' notice of the time and place when and where they will meet to hear any representation in behalf of the said corporation or of the board or boards of chosen freeholders of the various counties through which the said turnpike runs, or of the applying freeholders in the said matter; said notice shall be served upon the president or other chief officer of said corporation, upon the director or clerk of the said board or boards of chosen freeholders, and shall be published at least one week prior to the time of meeting in one newspaper published in each county through which said turnpike runs; such meeting shall be adjourned from time to time at the discretion of the said commissioners; when the said commissioners shall have arrived at a price or value of the said turnpike road satisfactory to themselves they shall report the same to the road commissioner, who may thereupon ratify the same and report it to the board or boards of chosen freeholders of the counties through which the said road runs, who may thereupon purchase the same; and they are hereby empowered to make temporary loans upon the credit of the said county or counties for the acquirement of the said roads as aforesaid.

Commissioners appointed.

Hearings had.

Notice given.

Temporary loans may be made.

2. One-third of the cost of all roads so acquired under this act shall be paid for out of the state road appropria-

Cost.

Proviso.

tion; *provided*, that the amount so paid shall not in any one year exceed the amount of twenty thousand dollars; if one-third of such cost shall exceed the sum of twenty thousand dollars, the said sum of twenty thousand dollars shall be apportioned by the governor and the state commissioner of public roads among the counties of this state in proportion to the cost of the roads acquired by them for such year as shown by the statement of cost filed in the office of the state commissioner of public roads; the governor and the said commissioner shall, between December fifteenth and thirty-first in each year, certify to the state comptroller the amount to be paid to each county for such year, and the state comptroller shall thereupon draw his warrants in favor of the respective county collectors for the sums certified to as aforesaid upon the state treasurer, who shall pay the same out of any moneys in the state treasury not otherwise appropriated; *provided further*, that the cost of all turnpike roads acquired under this act in any county in any one year, together with all roads built or repaired, shall not exceed one-fourth of one per centum of the ratables of such county for the last preceding year.

Proviso.

Assessors to
include certain
amount in
county taxes.

3. On or before August first in each and every year it shall be the duty of the board of chosen freeholders to certify to the county board of assessors, either in the annual tax budget or separately, the two-thirds of the cost of all turnpike roads acquired so as aforesaid during the year, and the county board of assessors shall include the sum so certified in the county taxes assessed for such year, and the same shall be assessed, collected and paid over to the county in the same manner and within the same time that other county taxes are assessed, collected and paid over; if a deficiency shall exist in consequence of the receipt of less than one-third of the cost from the state treasury, the board of chosen freeholders shall have the authority to borrow on temporary loans to the

Deficiency.

amount of such deficiency until the next annual taxes shall be assessed, collected and paid over to the county.

4. If the said road shall run through more than one county the petition to the state commissioner of public roads shall be signed by at least two-thirds of the owners of land and real estate bordering on said road in each county before the governor shall be required to appoint the five commissioners mentioned in the first section of this act; and each of the said counties shall bear the expenses of the acquirement of the said road in proportion to the length thereof within the said counties, and all proceedings after the appointment of the said five commissioners that may be required by virtue of this act shall be had separately and independently in each of the said counties.

If the road is in more than one county.

5. Any road so acquired shall forever thereafter be a free county road, and the duty of keeping the same in good order and repair shall devolve upon the county officers in like manner as heretofore provided for free stone roads.

Road to be free and maintained by county.

6. When the said turnpike roads shall have been so acquired the board of chosen freeholders shall apply to the circuit court of the county for the appointment of commissioners to estimate and assess the peculiar benefits conferred by such acquirement upon the lands and real estate bordering on the road so acquired, of the time and place of which application notices shall be given by ten days' publication in two daily newspapers printed and circulating within the said counties, then by two weeks' publication in two weekly newspapers printed and circulating therein, at which time and place or at such other time and place as the court shall designate, shall, without unnecessary delay, appoint three commissioners, who shall be freeholders, and residents of the county in which the application is made, to assess the benefits aforesaid; the said court shall have power to remove any commissioner and appoint another in his place and also fill any

Benefits assessed by commissioners appointed by court.

Method of
assessing
benefits.

vacancy that may occur in the office of any commissioner at any time.

7. The said commissioners shall then proceed in like manner as the commissioners appointed to assess the benefits conferred by the improvement of the public roads of this state under and by virtue of an act of the legislature entitled "An act to provide for the permanent improvement of the public roads of this state," approved March twenty-second, one thousand eight hundred and ninety-five, and the supplements thereto, and the report of the said commissioners when filed and approved shall be a lien upon the properties assessed in like manner, and the said assessment shall be collected in like manner as the assessment in the said act last before mentioned.

8. This act shall take effect immediately.

Approved May 11, 1897.

Broad Tires.

CHAPTER 76.

An Act to amend an act entitled "An act to enable township committees to encourage the use of broad tires on wagons and carts by a rebatement of taxes."

I. BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey*, That section one of an act entitled "An act to enable township committees to encourage the use of broad tires on wagons and carts by a rebatement of taxes," approved March sixteenth, one thousand eight hundred and ninety-three, which reads as follows:

I. "BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey*, That township committees be and they are hereby authorized, when in their judgment it is for the public good, to pass an ordinance allowing a rebate of taxes for township or road purposes to all

owners or possessors of wagons and carts used in said township for transportation of goods, wares, merchandise, produce, passengers, and for general farm, freight and express purposes, having tires of not less than four inches in width; *provided*, the said rebate shall not exceed fifty cents for each wheel in use in any one year," be and the same is hereby amended so as to read as follows:

1. BE IT ENACTED *by the Senate and General Assembly of the State of New Jersey*, That township committees be and they are hereby authorized, when in their judgment it is for the public good, to pass an ordinance allowing a rebate of taxes for township or road purposes to all owners or possessors of wagons and carts used in said township for transportation of goods, wares, merchandise, produce, passengers, and for general farm, freight and express purposes, having tires of not less than four inches in width; *provided*, the said rebate shall not exceed one dollar for each wheel in use in any one year.

2. That this act shall take effect immediately.

Passed March 24th, 1896.

APPENDIX C.

NEW JERSEY.

1. All road taxes are to be paid in money.
2. The office of overseer of highway is abolished.
3. The roads of a township are placed under the management of the township committee, and money may be raised by township bonds for grading, macadamizing and improving the same; bonds to be authorized by vote at the annual town meeting.

4. Under the County act, the Board of Chosen Freeholders of any county may designate certain roads as county roads, and improve the same by the issue of county bonds; townships to pay one-third of the cost.

5. Under the County State Aid law, whenever the owners of two-thirds of the lands fronting on any public road will undertake to pay one-tenth of the cost of improving such road, the Board of Chosen Freeholders may cause such improvements to be made, the State paying one-third of the cost up to, at present, the limit of \$150,000 per year.

Under the Township State Aid law whenever the owners of two-thirds of the lands fronting on any public road will undertake to pay one-tenth of the cost of improving the same, the township committee may cause such improvements to be made, the State paying one-third of the cost, less the ten per cent., and the township 67 per cent., the township forever keeping the road in repair.

6. Under the act for the acquirement of turnpike roads for free public use, whenever the owners of two-thirds of

the land fronting on any turnpike toll-road pray that said road may be acquired for free public use, and that they are willing to pay ten per cent. of the entire cost of such road, the Governor appoints five commissioners to estimate and determine the fair and just value of said road; after having arrived at such value, if the State Road Commissioner ratifies the same, the board may purchase, the State paying one-third of the cost and the county paying the balance, fifty-seven per cent.

LAYING OUT ROADS.

Receiving many inquiries how to proceed to lay out roads, change location, etc., to save correspondence we give the following quotations from the statutes.

Laying out Roads by Freeholders after General Election.

It shall be lawful for the Board of Chosen Freeholders of any of the several counties of this State, when said board deem it for the best interests of such county, to lay out, construct and maintain public roads extending through such county in any direction, to submit, by resolution, the question whether or not such public roads shall be laid out, to the electors of said county, at an election, to be held at the same time and place of holding the general election in and for said county for members of the General Assembly of this State, by the same officers, but in separate ballot-box, and if, at such election, a majority of the electors shall vote "against public roads," nothing in this act shall apply or be effective in said county; but if a majority of the electors vote "in favor of public road," then the board shall proceed as directed by the act entitled "An act to authorize the board of chosen freeholders of any of the several counties of this State to lay out, open, construct, improve and maintain a public road therein," approved April 7th, 1888. P. L. 1888, page 397.

LAYING OUT, VACATING OR ALTERING PUBLIC ROADS.

BY SURVEYORS OF HIGHWAYS. (Revised Statutes, page 2828-119, Sec. 1.)

That when ten or more persons, being freeholders, shall think a public road necessary, or any public road which hath been or shall be laid out unnecessary, or any alteration in such road necessary in any part of the county in which they reside, it shall be lawful for the said persons to make application in writing to the inferior court of common pleas of the said county, in open court, having given previous notice for at least ten days of such intended application, and also of the day on which such application is intended to be made, by advertisements under their hands, and set up at three of the most public places in the township in which the said road is proposed to be laid out, vacated or altered, and if there be more townships than one through which the said road may run, by advertisements to be set up at three of the most public places in each township; and the said court, when applied to as aforesaid, on due proof being made that the advertisements have been set up according to law, on which the judgment of the court shall be final and conclusive, are hereby authorized and required to appoint six of the surveyors of the highways of the said county, ever having regard to the appointment of the surveyors of the highways of the township or townships where the said road shall be so applied for to be laid out, vacated or altered; *provided*, that no surveyor shall be appointed through whose land the road may run, or who for any other reason which the court in their discretion shall deem sufficient, think ought not to be appointed; and the said surveyors shall meet at such time and place as the said court shall direct, a copy of which appointment shall be served on each of the said surveyors at least six days prior to the time of their meeting; and two of the said applicants shall,

at least twelve days prior to the said time, sign and set up advertisements at three of the most public places in the said township or townships, setting forth the time and place of the meeting of the surveyors agreeably to the directions of the court, and designating the points or places from and to which the said road is proposed to be laid out, vacated or altered. (See Secs. 138 and 168, *post.*)

VACATION AND RELAYING OF PUBLIC ROADS BY FILING
CONSENT WITH CLERK AND RECORDING.

138. Sec. 1. That whenever ten or more persons, being freeholders, shall think any alteration of any public road necessary in any part of the county wherein they reside, by having such road or a portion thereof vacated, and the same relaid or another road substituted therefor, they may make application in writing to the inferior court of common pleas of such county, or to one of the judges thereof, setting forth in writing the road or portion thereof as aforesaid which it is proposed to have vacated, describing the same by courses and distances, and also describing the road as it is to be relaid, or the road which is to be substituted therefor, to which description there shall be attached a map showing the location of the road or portion of road to be vacated and the road as relaid, or the road which is to be substituted therefor; and if within ten days after such application shall have been made as aforesaid, or if at the time of making such application there shall be presented to said court or judge the consent in writing of the owners of all the lands intersected by such old road or portion thereof proposed to be vacated, and of all the property intersected by the road as proposed to be relaid, or by the road which it is proposed to substitute therefor, and also the written consent of the township committee of the township wherein such road or roads do lie, that said application shall be granted,

then it shall be lawful for said court or judge to cause said application, with the accompanying survey, map and return, and the written consents of the owners of lands as aforesaid, and of the township committee, to be filed with the clerk of the county, to be by him recorded in the book of roads for said county; and when said application and other papers shall have been so filed, such old road or portion thereof shall thereupon and thereby be deemed to be vacated, and the road is relaid, or the new road substituted therefor, shall thereupon and thereby be deemed and taken to be a public road.

VACATION OF PUBLIC ROADS BY CONSENT AND FILING
WITH COUNTY CLERK.

168. Sec. 1. That whenever ten or more persons, being freeholders, shall think the vacation of a part of any public road necessary in any part of the county wherein they reside, they may make application in writing to the inferior court of common pleas of such county, or to one of the judges thereof, setting forth in writing the road or portion thereof which it is proposed to have vacated, describing the same by courses and distances, to which description there shall be attached a map showing the location of the road, or portion thereof to be vacated, and if within ten days after such application shall have been made as aforesaid, or if at the time of making such application, there shall be presented to said court or judge the consent in writing of the owners of all the lands by such old road or portion thereof proposed to be vacated, and also the written consent of the township committee of the township wherein such lands do lie, that such application shall be granted, then it shall be lawful for said court or judge to cause said application, with the accompanying survey, map and return, and the written consents of the owners of lands as aforesaid, and of the town-

ship committee, to be filed with the clerk of the county, to be by him recorded in the book of roads for said county, and when said application and papers have been so filed, such portion of such old road shall thereupon and thereby be deemed to be vacated; *provided*, that no portion of any old road proposed to be vacated under this act shall exceed one thousand yards in length.

APPENDIX D.

Number of tons of stone per mile required to build the following depths and widths.

For the information of intending road-builders, we have compiled the following tables, which approximate the number of tons of thoroughly-rolled stone necessary to construct each mile at the designated depths and widths.

The basis is 3,000 tons of loose stone or 3,500 tons of compressed stone for a road one mile long, sixteen feet wide and eight inches deep. A road eight inches deep, when finished, will have required at least ten inches of stone. It should be placed in two layers of five inches each, and each layer rolled down to four inches. Then the application of the three-quarter inch and screenings will bring the road to the prescribed depth; for other thickness the stone should be placed in proportion to the intended finished depths.

An observance of this rule will insure the contract thickness for the road-bed, and save the sometimes necessary expense of resurfacing before acceptance from the contractor.

A road 8 feet wide and 4 inches deep will require						875 tons of stone per mile				
"	8	"	"	6	"	"	1,312½	"	"	"
"	8	"	"	8	"	"	1,750	"	"	"
"	8	"	"	10	"	"	2,187½	"	"	"
"	8	"	"	12	"	"	2,625	"	"	"
"	9	"	"	4	"	"	984¾	"	"	"
"	9	"	"	6	"	"	1,476 9-16	"	"	"
"	9	"	"	8	"	"	1,968¾	"	"	"
"	9	"	"	10	"	"	2,460 15-16	"	"	"
"	9	"	"	12	"	"	2,953⅓	"	"	"
"	10	"	"	4	"	"	1,093¾	"	"	"
"	10	"	"	6	"	"	1,640⅝	"	"	"
"	10	"	"	8	"	"	2,187½	"	"	"
"	10	"	"	10	"	"	2,734⅜	"	"	"
"	10	"	"	12	"	"	3,281¼	"	"	"

A road 11 feet wide and 4 inches deep will require 1,203 $\frac{1}{8}$ tons of stone per mile

"	11	"	"	6	"	"	1,804 11-16	"	"	"
"	11	"	"	8	"	"	2,406 $\frac{1}{4}$	"	"	"
"	11	"	"	10	"	"	3,007 13-16	"	"	"
"	11	"	"	12	"	"	3,609 $\frac{3}{8}$	"	"	"
"	12	"	"	4	"	"	1,312 $\frac{1}{2}$	"	"	"
"	12	"	"	6	"	"	1,968 $\frac{3}{4}$	"	"	"
"	12	"	"	8	"	"	2,625	"	"	"
"	12	"	"	10	"	"	3,281 $\frac{1}{4}$	"	"	"
"	12	"	"	12	"	"	3,937 $\frac{1}{2}$	"	"	"
"	13	"	"	4	"	"	1,421 $\frac{7}{8}$	"	"	"
"	13	"	"	6	"	"	2,132 13-16	"	"	"
"	13	"	"	8	"	"	2,843 $\frac{3}{4}$	"	"	"
"	13	"	"	10	"	"	3,554 11-16	"	"	"
"	13	"	"	12	"	"	4,265 $\frac{5}{8}$	"	"	"
"	14	"	"	4	"	"	1,531 $\frac{1}{4}$	"	"	"
"	14	"	"	6	"	"	2,296 $\frac{7}{8}$	"	"	"
"	14	"	"	8	"	"	3,062 $\frac{1}{2}$	"	"	"
"	14	"	"	10	"	"	3,828 $\frac{1}{8}$	"	"	"
"	14	"	"	12	"	"	4,593 $\frac{3}{4}$	"	"	"
"	15	"	"	4	"	"	1,640 $\frac{5}{8}$	"	"	"
"	15	"	"	6	"	"	2,460 15-16	"	"	"
"	15	"	"	8	"	"	3,281 $\frac{1}{4}$	"	"	"
"	15	"	"	10	"	"	4,101 9-16	"	"	"
"	15	"	"	12	"	"	4,921 $\frac{7}{8}$	"	"	"
"	16	"	"	4	"	"	1,750	"	"	"
"	16	"	"	6	"	"	2,625	"	"	"
"	16	"	"	8	"	"	3,500	"	"	"
"	16	"	"	10	"	"	4,375	"	"	"
"	16	"	"	12	"	"	5,250	"	"	"
"	17	"	"	4	"	"	1,859 $\frac{3}{8}$	"	"	"
"	17	"	"	6	"	"	2,789 1-16	"	"	"
"	17	"	"	8	"	"	3,718 $\frac{3}{4}$	"	"	"
"	17	"	"	10	"	"	4,648 7-16	"	"	"
"	17	"	"	12	"	"	5,578 $\frac{1}{8}$	"	"	"
"	18	"	"	4	"	"	1,968 $\frac{3}{4}$	"	"	"
"	18	"	"	6	"	"	2,953 $\frac{1}{8}$	"	"	"
"	18	"	"	8	"	"	3,937 $\frac{1}{2}$	"	"	"
"	18	"	"	10	"	"	4,921 $\frac{7}{8}$	"	"	"
"	18	"	"	12	"	"	5,906 $\frac{1}{4}$	"	"	"

A road 19 feet wide and 4 inches deep will require 2,078 $\frac{1}{8}$ tons of stone per mile

"	19	"	"	6	"	"	3,117 3-16	"	"	"
"	19	"	"	8	"	"	4,156 $\frac{1}{4}$	"	"	"
"	19	"	"	10	"	"	5,195 5-16	"	"	"
"	19	"	"	12	"	"	6,234 $\frac{3}{8}$	"	"	"
"	20	"	"	4	"	"	2,187 $\frac{1}{2}$	"	"	"
"	20	"	"	6	"	"	3,281 $\frac{1}{4}$	"	"	"
"	20	"	"	8	"	"	4,375	"	"	"
"	20	"	"	10	"	"	5,468 $\frac{3}{4}$	"	"	"
"	20	"	"	12	"	"	6,562 $\frac{1}{2}$	"	"	"

TABLES.

As many persons interested in the construction of stone roads are asking questions about their cost, we inclose a table to show at a glance the number of square yards at different widths in a mile of road; also the cost at different widths and various prices per square yard. Any variations from these prices can be quickly ascertained, by adding, subtracting, multiplying and dividing, for a less or greater width. For example, a road eight feet wide has 4,693 1-3 square yards in one mile. Nine feet wide would be obtained by adding one-eighth of that number of square yards; for seven feet wide you would subtract one-eighth of that number of square yards. For twice that number of feet you would multiply by two.

SQUARE YARDS IN ONE MILE OF

8 feet in width.....	4,693 1-3 square yards.
10 "	5,866 2-3 "
12 "	7,040 "
14 "	8,213 1-3 "
16 "	9,386 2-3 "
18 "	10,560 "

8 feet wide, or 4,693 1-3 square yards, at 25c. per yard.....	\$1,173 33 1-3
10 " 5,866 2-3 " 25c. "	1,466 66 2-3
12 " 7,040 " 25c. "	1,760 00
14 " 8,213 1-3 " 25c. "	2,053 33 1-3
16 " 9,386 2-3 " 25c. "	2,346 66 2-3
18 " 10,560 " 25c. "	2,640 00
8 " 4,693 1-3 " 30c. "	\$1,408 00
10 " 5,866 2-3 " 30c. "	1,760 00
12 " 7,040 " 30c. "	2,112 00
14 " 8,213 1-3 " 30c. "	2,464 00
16 " 9,386 2-3 " 30c. "	2,816 00
18 " 10,560 " 30c. "	3,168 00

8 feet wide, or 4,693 I-3 square yards, at 35c. per yard.....							\$1,642 66 2-3
10	"	5,866 2-3	"	35c.	"	.....	2,053 33 I-3
12	"	7,040	"	35c.	"	.....	2,464 00
14	"	8,213 I-3	"	35c.	"	.....	2,874 66 2-3
16	"	9,386 2-3	"	35c.	"	.....	3,285 33 I-3
18	"	10,560	"	35c.	"	.....	3,696 00
8	"	4,693 I-3	"	40c.	"	.....	\$1,877 33 I-3
10	"	5,866 2-3	"	40c.	"	.....	2,346 66 2-3
12	"	7,040	"	40c.	"	.....	2,816 00
14	"	8,213 I-3	"	40c.	"	.....	3,285 33 I-3
16	"	9,386 2-3	"	40c.	"	.....	3,754 66 2-3
18	"	10,560	"	40c.	"	.....	4,224 00
8	"	4,693 I-3	"	45c.	"	.....	\$2,112 00
10	"	5,866 2-3	"	45c.	"	.....	2,640 00
12	"	7,040	"	45c.	"	.....	3,168 00
14	"	8,213 I-3	"	45c.	"	.....	3,696 00
16	"	9,386 2-3	"	45c.	"	.....	4,224 00
18	"	10,560	"	45c.	"	.....	4,752 00
8	"	4,693 I-3	"	50c.	"	.....	\$2,346 66 2-3
10	"	5,866 2-3	"	50c.	"	.....	2,933 33 I-3
12	"	7,040	"	50c.	"	.....	3,520 00
14	"	8,213 I-3	"	50c.	"	.....	4,106 66 2-3
16	"	9,386 2-3	"	50c.	"	.....	4,693 33 I-3
18	"	10,560	"	50c.	"	.....	5,280 00
8	"	4,693 I-3	"	55c.	"	.....	\$2,581 33 I-3
10	"	5,866 2-3	"	55c.	"	.....	3,226 66 2-3
12	"	7,040	"	55c.	"	.....	3,872 00
14	"	8,213 I-3	"	55c.	"	.....	4,517 33 I-3
16	"	9,386 2-3	"	55c.	"	.....	5,162 66 2-3
18	"	10,560	"	55c.	"	.....	5,808 00
8	"	4,693 I-3	"	60c.	"	.....	\$2,816 00
10	"	5,866 2-3	"	60c.	"	.....	3,520 00
12	"	7,040	"	60c.	"	.....	4,224 00
14	"	8,213 I-3	"	60c.	"	.....	4,928 00
16	"	9,386 2-3	"	60c.	"	.....	5,632 00
18	"	10,560	"	60c.	"	.....	6,336 00
8	"	4,693 I-3	"	65c.	"	.....	\$3,050 66 2-3
10	"	5,866 2-3	"	65c.	"	.....	3,813 33 I-3
12	"	7,040	"	65c.	"	4,576 00
14	"	8,213 I-3	"	65c.	"	5,338 66 2-3
16	"	9,386 2-3	"	65c.	"	6,101 33 I-3
18	"	10,560	"	65c.	"	6,864 00

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8 feet wide, or 4,693 1-3 square yards, at 70c. per yard,							\$3,285	33	1-3
10	"	5,866 2-3	"	70c.	"	4,106	66	2-3
12	"	7,040	"	70c.	"	.....	4,928	00	
14	"	8,213 1-3	"	70c.	"	.....	5,749	33	1-3
16	"	9,386 2-3	"	70c.	"	.....	6,570	66	2-3
18	"	10,560	"	70c.	"	.....	7,392	00	
8	"	4,693 1-3	"	75c.	"	.....	\$3,520	00	
10	"	5,866 2-3	"	75c.	"	.....	4,400	00	
12	"	7,040	"	75c.	"	.....	5,280	00	
14	"	8,213 1-3	"	75c.	"	.....	6,160	00	
16	"	9,386 2-3	"	75c.	"	.....	7,040	00	
18	"	10,560	"	75c.	"	.....	7,920	00	
8	"	4,693 1-3	"	80c.	"	.....	\$3,754	66	2-3
10	"	5,866 2-3	"	80c.	"	.....	4,693	33	1-3
12	"	7,040	"	80c.	"	.....	5,632	00	
14	"	8,213 1-3	"	80c.	"	.....	6,570	66	2-3
16	"	9,386 2-3	"	80c.	"	.....	7,509	33	1-3
18	"	10,560	"	80c.	"	.....	8,448	00	
8	"	4,693 1-3	"	85c.	"	.....	\$3,989	33	1-3
10	"	5,866 2-3	"	85c.	"	.....	4,986	66	2-3
12	"	7,040	"	85c.	"	.....	5,984	00	
14	"	8,213 1-3	"	85c.	"	.....	6,981	33	1-3
16	"	9,386 2-3	"	85c.	"	.....	7,978	66	2-3
18	"	10,560	"	85c.	"	.....	8,976	00	
8	"	4,693 1-3	"	90c.	"	.....	\$4,224	00	
10	"	5,866 2-3	"	90c.	"	.....	5,280	00	
12	"	7,040	"	90c.	"	.....	6,336	00	
14	"	8,213 1-3	"	90c.	"	.....	7,392	00	
16	"	9,386 2-3	"	90c.	"	.....	8,448	00	
18	"	10,560	"	90c.	"	.....	9,504	00	
8	"	4,693 1-3	"	95c.	"	.....	\$4,458	66	2-3
10	"	5,866 2-3	"	95c.	"	.....	5,573	33	1-3
12	"	7,040	"	95c.	"	.....	6,688	00	
14	"	8,213 1-3	"	95c.	"	.....	7,802	66	2-3
16	"	9,386 2-3	"	95c.	"	.....	8,917	33	1-3
18	"	10,560	"	95c.	"	.....	10,032	00	
8	"	4,693 1-3	"	\$1.00	"	.....	\$4,693	33	1-3
10	"	5,866 2-3	"	1.00	"	.....	5,866	66	2-3
12	"	7,040	"	1.00	"	.....	7,040	00	
14	"	8,213 1-3	"	1.00	"	.....	8,213	33	1-3
16	"	9,386 2-3	"	1.00	"	.....	9,386	66	2-3
18	"	10,560	"	1.00	"	.....	10,560	00	

TABLE FOR GRAVEL.

Table showing number of cubic yards of gravel required in the construction of one mile of gravel road, of widths varying from 6 feet to 20 feet, and depth from 6 to 12 inches. The within quantities should be multiplied by $1\frac{1}{2}$ to give the number of cubic yards of loose gravel required to make the within depths of compact gravel.

One mile in length.	Number of feet in width.	Number of cubic yards in road 6 inches deep.	Number of cubic yards in road 7 inches deep.	Number of cubic yards in road 8 inches deep.	Number of cubic yards in road 9 inches deep.	Number of cubic yards in road 10 inches deep.	Number of cubic yards in road 11 inches deep.	Number of cubic yards in road 12 inches deep.
One mile.	6 ft. wide	586 ² ₃	684 ⁴ ₇	782 ² ₃	880	977 ⁹ ₉	1,075 ⁵ ₉	1,173 ¹ ₃
"	7 "	684 ⁴ ₉	798 ¹⁴ ₂₇	912 ¹⁶ ₂₇	1,026 ² ₃	1,140 ²⁰ ₂₇	1,254 ²² ₂₇	1,368 ⁸ ₉
"	8 "	782 ² ₉	912 ¹⁶ ₂₇	1,042 ²⁶ ₂₇	1,173 ¹ ₃	1,303 ¹⁹ ₂₇	1,434 ² ₂₇	1,564 ⁴ ₉
"	9 "	880	1,026 ² ₃	1,173 ¹ ₃	1,320	1,466 ² ₃	1,613 ¹ ₃	1,760
"	10 "	977 ⁹ ₉	1,140 ²⁰ ₂₇	1,303 ¹⁹ ₂₇	1,466 ² ₃	1,629 ¹⁷ ₂₇	1,792 ¹⁶ ₂₇	1,955 ⁵ ₉
"	11 "	1,075 ⁵ ₉	1,254 ²² ₂₇	1,434 ² ₂₇	1,613 ¹ ₃	1,792 ¹⁶ ₂₇	1,971 ²³ ₂₇	2,151 ⁹ ₉
"	12 "	1,173 ¹ ₃	1,368 ⁸ ₉	1,564 ⁴ ₉	1,760	1,955 ⁵ ₉	2,151 ⁹ ₉	2,346 ² ₃
"	13 "	1,271 ¹⁰ ₂₇	1,482 ²⁸ ₂₇	1,694 ⁸ ₂₇	1,906 ⁸ ₉	2,118 ¹⁴ ₂₇	2,330 ¹⁰ ₂₇	2,542 ⁸ ₉
"	14 "	1,368 ⁸ ₉	1,597 ²⁷ ₂₇	1,825 ²⁷ ₂₇	2,053 ¹ ₃	2,281 ¹³ ₂₇	2,509 ¹⁷ ₂₇	2,737 ⁷ ₉
"	15 "	1,466 ² ₃	1,711 ⁹ ₂₇	1,955 ⁵ ₉	2,200	2,444 ⁴ ₉	2,688 ⁸ ₉	2,933 ¹ ₃
"	16 "	1,564 ⁴ ₉	1,825 ²⁷ ₂₇	2,085 ²⁵ ₂₇	2,346 ² ₃	2,607 ¹¹ ₂₇	2,868 ⁴ ₉	3,128 ⁸ ₉
"	17 "	1,662 ² ₉	1,919 ⁷ ₂₇	2,216 ² ₂₇	2,493 ¹ ₃	2,770 ¹⁰ ₂₇	3,047 ¹¹ ₂₇	3,324 ⁴ ₉
"	18 "	1,760	2,053 ¹ ₃	2,346 ² ₃	2,640	2,933 ¹ ₃	3,226 ² ₃	3,520
"	19 "	1,857 ⁷ ₉	2,167 ¹¹ ₂₇	2,477 ¹¹ ₂₇	2,786 ² ₃	3,096 ⁸ ₂₇	3,405 ²⁵ ₂₇	3,715 ⁵ ₉
"	20 "	1,955 ⁵ ₉	2,281 ¹³ ₂₇	2,607 ¹¹ ₂₇	2,933 ¹ ₃	3,259 ⁷ ₂₇	3,585 ⁵ ₂₇	3,911 ⁹ ₉

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